

MEMORANDUM 1/03/2001

SUBJECT: Revised Residue Chemistry Chapter For The Endosulfan Reregistration Eligibility Decision (RED) Document.

DP Barcode: D268277
Chemical No. 079401
Case No: 0014

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Attached is a revised version of the Residue Chemistry Chapter for the Endosulfan Reregistration Eligibility Decision (RED) document. This chapter was completed by the Dynamac Corporation under supervision of HED and has undergone secondary review/modification in Reregistration Branch 2 for consistency with current EPA policies. This version contains updated information derived from the registrant's response to the chapter issued 1/22/2000, additional residue chemistry studies (MRIDs 45190801, 44972301), revised use closure information, and a letter from the registrants dated November 3, 2000 to Dr. John Punzi c/o Ms. Stacey Milan.

The existing residue chemistry database is incomplete.

Label revisions are required for many crops in order to reflect the parameters of use patterns for which residue data are available. Most of the required label revisions pertain to the establishment of preharvest intervals.

The qualitative nature of the residue of endosulfan in plants and animals has been adequately identified/characterized.

Adequate analytical methods exist for data collection and tolerance enforcement.

Adequate storage stability data are available for all supported crops.

Results from animal feeding studies suggest that no tolerances are necessary for poultry or egg commodities and support tolerances for meats and milk.

Adequate residue data exist for many processed food/feed commodities.

The reregistration requirements for magnitude of the residue in/on the following RACs have not been fulfilled, and field trial data are required: barley flour, hay, bran and pearled barley; oat forage, hay, flour, and rolled oats; rye forage, flour, and bran; sugar cane; wheat forage, hay, aspirated grain fractions.

Adequate limited field rotational crop trials have been conducted on representative crops.

The need for additional tolerances and for revisions to dietary exposure/risk assessments will be determined upon receipt of the required residue chemistry data.

cc: JSPunzi(RRB2), Endosulfan Reg. Std. File, Endosulfan SF, RF, LAN.
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ENDOSULFAN

REREGISTRATION ELIGIBILITY DECISION

RESIDUE CHEMISTRY CONSIDERATIONS

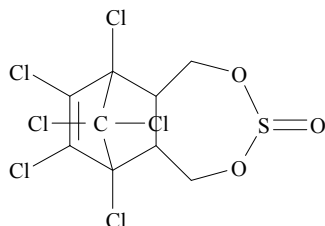
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ENDOSULFAN



REREGISTRATION ELIGIBILITY DECISION

RESIDUE CHEMISTRY CONSIDERATIONS

P.C. No. 079401; Case 0014

INTRODUCTION

Endosulfan (6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9,-methano-2,4,3-benzodioxathiepin-3-oxide) is a broad spectrum insecticide/acaricide registered for use on a variety of field, fruit, and vegetable crops. The reregistration of endosulfan in the United States is being supported by The Endosulfan Task Force members consisting of AgrEvo USA Company, FMC Corporation, and Makhteshim-Agan of North America; the Interregional Research Project No.4 (IR-4) is additionally supporting the reregistration of endosulfan use on a few selected minor crops. Endosulfan products registered to the Task Force are marketed under the trade names Thiodan®, Phaser®, and Thionex®. Only emulsifiable concentrate (EC) and wettable powder (WP) are the endosulfan formulation classes registered to the Task Force for food/feed uses. Depending on the crops, these formulations may be applied as dormant, delayed dormant, prebloom, foliar, postharvest treatment, bark, soil (broadcast and banded), and soil drench treatments using ground, chemigation, or aerial equipment.

REGULATORY BACKGROUND

Endosulfan was the subject of a Reregistration Standard Guidance Document dated 4/82; the Residue Chemistry Science Chapter of the Guidance Document was dated 9/81. The Residue Chemistry Chapter Update of the Endosulfan Reregistration Standard was issued on 8/9/90. These documents summarized the regulatory conclusions based on available residue chemistry data and specified the additional data required for reregistration purposes. Several data submissions have been received and evaluated since the Update. The information contained in this document outlines the Residue Chemistry Science Assessments with respect to the reregistration of endosulfan.

Tolerances have been established for residues of endosulfan in/on various plant and animal commodities under 40 CFR §180.182 and in processed food commodities under 40 CFR §185.2600. These tolerances range from 0.1 ppm to 24 ppm and are currently expressed in terms of endosulfan and its metabolite, endosulfan sulfate (6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9,-methano-2,4,3-benzodioxathiepin-3,3-dioxide). Adequate methods are available for data collection and tolerance enforcement. Codex maximum residue limits (MRL)s are expressed as the sum of α - and β -endosulfan and endosulfan sulfate.

The Food Quality Protection Act (FQPA) of 1996 has amended and strengthened the standard for establishing tolerances under the Federal Food, Drug, and Cosmetic Act (FFDCA). The Office of Pesticide Programs (OPP) is still assessing the full impact of this change in the law, and plans to issue guidelines concerning the establishment and reassessment of tolerances under the amended statute. All future tolerance petitions as well as reassessment of established tolerances must meet the requirements of the FFDCA as amended by the FQPA. OPP may require additional data to determine if the terms of the amended statute are met.

The Agency has recently updated the list of raw agricultural and processed commodities and feedstuffs derived from crops (Table 1, OPPTS 860.1000). As a result of changes to Table 1, additional endosulfan residue data are now required for some commodities; these data requirements have been incorporated into this document. These new data requirements will be imposed at the issuance of the Endosulfan RED but should not impinge on the reregistration eligibility decisions for endosulfan. The need for revisions to dietary exposure/risk assessments will be determined upon receipt of the required residue chemistry data.

SUMMARY OF USE AND SCIENCE FINDINGS

GLN 860.1200: Directions for Use

There are presently 12 endosulfan end-use products (EPs) registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 3 to The Endosulfan Task Force members [*Source: REFS search, conducted 12/2/99*]. These EPs, including the associated Special Local Need (SLN) registrations under FIFRA Section 24(c), are listed in Table 1.

Table 1. Endosulfan EPs with Food/Feed Uses Registered to The Endosulfan Task Force members (AgrEvo USA Company, FMC Corporation, and Makhteshim-Agan of North America).

EPA Reg. No.	Label Acceptance Date ¹	Formulation	Product Name
FMC Corporation			
279-1380 ²	9/3/98	50% WP	Thiodan 50 WP Insecticide
279-2659 ³	11/21/97	2 lb/gal EC	Thiodan 2 C.O. EC Insecticide
279-2735	11/21/97	2 lb/gal EC	Thiodan Pyrenone C.O. EC Insecticide
279-2822	11/21/97	2 lb/gal EC	Thiodan 2 Pyrenone 0.3-0.03 EC Insecticide
279-2924 ⁴	4/22/99	3 lb/gal EC	Thiodan 3 E.C. Insecticide
279-3129	11/13/97	50% WP	Thiodan WSB Insecticide
279-3222	9/27/99	3 lb/gal EC	Methyl Parathion 2 Thiodan 3 EC
AgrEvo USA Company			
45639-169 ⁵	4/16/98	3 lb/gal EC	Phaser 3 EC Insecticide
45639-194	4/16/98	50% WP	Phaser 50 WSB Insecticide
45639-197	4/16/98	3 lb/gal EC	Phaser 3 EC Insecticide-For Use in CA
45639-198	4/16/98	50% WP	Phaser 50 WSB Insecticide-For Use in CA
Makhteshim-Agan of North America, Inc.			
66222-2	4/3/95	50% WP	Thionex 50 WP Insecticide

¹ Date of the most recently EPA-approved label found in the product jacket or Pesticide Product Label System (PPLS) unless specified otherwise.

² Including SLN Nos. HI880008, MS810036, OR780020, WA780029, and WA780033.

³ Including SLN Nos. AZ930014, AZ930016, and CA97002800

⁴ Including SLN Nos. AL910003, AR900003, CA760115, CA860035, CA900031, CA940006, GA900009, HI98000200, ID770009, ID97000900, IN890003, KY890002, MI910004, MS810035, MS900003, MT790024, ND98000300, NV860005, OH890006, OR770043, OR98000800, PA920002, SC910001, TN900002, VA920007, WA770016, WA900023, WA92000100, WA98001600, WI920007, and WI99000100.

⁵ Including SLN Nos. AZ980005, ID980011, and ID980012.

Food/feed uses: A comprehensive summary of endosulfan food/feed use patterns, based on the product labels registered to the Endosulfan Task Force members, is presented below (Table 6). Two notices (62 FR 6776-6777 dated 2/13/97 and 63 FR 13246-13248 dated 3/18/98) of receipt of requests for amendments to delete endosulfan uses in certain pesticide registrations were recently issued. **The deletion of endosulfan uses on the following crops have been proposed: alfalfa (grown for forage), artichokes, barley, oats, peas (grown for seed), rye, safflower, sugar beets, sunflower, watercress, and wheat.** The end-use-products registered to The Endosulfan Task Force members with requests for amendments to delete uses include: EPA

Reg. Nos. 279-1380, , 279-2306, , 279-2659, 279-2735, 279-2822, 279-2924, 279-3129, 11678-5, 11678-25, and 66222-2. **AgrEvo has notified the Agency with a letter dated 7/29/1997 that it wishes to withdraw a portion of the original deletion requests. The Task Force has informed the Agency that it wishes to keep uses of endosulfan on; barley, oats, rye, wheat, and beans (listed as bean cannery waste in the FR notice).** Unless The Endosulfan Task Force members or other registrants submit additional residue data, **alfalfa (grown for forage), artichokes, peas (grown for seed), safflower, sugar beets, sunflower, and watercress** should be deleted from all products containing endosulfan as the active ingredient concomitant with the revocations of tolerances.

Non-food/non-feed uses. Endosulfan is presently registered for use on several crops grown for seed (i.e., alfalfa, broccoli, cabbage, clover, collards, kale, kohlrabi, radish, rutabaga, and turnips) and on nonbearing citrus trees. Following examination of labels, the Agency classifies these uses as non-food. The specific rationales for non-food use determinations are listed below.

The SLN registrations of endosulfan on alfalfa grown for seed in CA (CA860035), NV (NV860005), and WA (WA880012) can be considered a non-food use assuming the individual states have adequate mechanisms to ensure that the treated crop is not diverted for consumption by humans and is not fed to livestock. The SLN labels presently specify restrictions prohibiting the feeding or grazing of treated foliage, crop residues, or seed millings and the use of treated seed for livestock food or feed.

The SLN registration of endosulfan on clover grown for seed in CA (CA900031) can be considered a nonfood use assuming the state of CA has adequate mechanisms to ensure that the treated crop is not diverted for consumption by humans and is not fed to livestock. The SLN labels specifies restrictions prohibiting the use of crop refuse as food or feed for livestock.

The SLN registrations of endosulfan on broccoli, cabbage, collards, kale, kohlrabi, radish, and turnips grown for seed in OR (OR770043) and WA (WA770016 and WA780029) have higher application rates than similar field-grown crops intended for human consumption. These registrations are considered nonfood uses based on an Agency policy memo entitled "Evaluation of Washington State Department of Agriculture Request for Nonfood/Nonfeed Status for Small-Seeded Crops" (DP Barcode D212168, B. Schneider, 2/14/96).

The registered use of endosulfan on nonbearing citrus trees is considered a nonfood use based on label restrictions prohibiting the applications to trees that will bear fruits within 12 months.

A tabular summary of the residue chemistry science assessments for reregistration of endosulfan is presented in Table 7 beginning on page 75. The status of reregistration requirements for each guideline topic listed in Table 7 is based on the use patterns registered to The Endosulfan Task Force members. For the purpose of generating this Residue Chemistry Chapter, the Agency examined the registered food/feed use patterns and reevaluated the available residue chemistry database for adequacy in supporting these use patterns. Label revisions are required for many crops in order to reflect the parameters of use patterns for which residue data are available. Most

of the required label revisions pertain to the establishment of preharvest intervals. Details of the required label amendments are presented in the respective endnote for GLN 860.1500 (Crop Field Trials) in Table 7.

When end-use product DCIs are developed (e.g., at issuance of the RED), RD should require that all end-use product labels (e.g., MAI labels, SLNs, and products subject to the generic data exemption) be amended such that they are consistent with the basic producer labels.

GLN 860.1300: Nature of the Residue - Plants

The reregistration requirements for plant metabolism are fulfilled. Acceptable metabolism studies depicting the qualitative nature of the residues in apple, cucumber, and lettuce have been submitted and evaluated.

In the apple metabolism study, the total radioactive residues (expressed as endosulfan equivalents) were 0.44-0.98 ppm in/on fruits harvested 0, 7, 14, and 21 days following a single foliar spray application of [¹⁴C]endosulfan to a mature apple tree at 1.34 lb ai/A (~0.5X max single application). Approximately 95% of the total radioactivity in fruits collected 21 days posttreatment was identified. The large majority of radioactive residues in/on fruits consisted of the α and β isomers of endosulfan with small amounts of the sulfate metabolite.

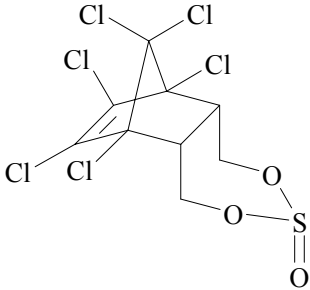
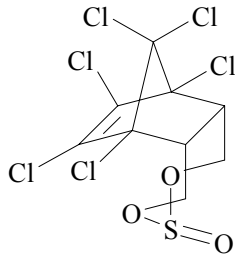
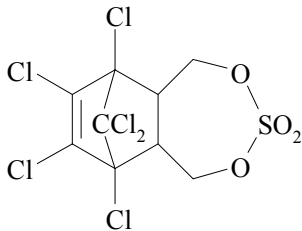
In the cucumber metabolism study, the total radioactive residues (expressed as endosulfan equivalents) were 0.18-0.26 ppm in/on fruits and 18-185 ppm in/on leaves following the last of three foliar spray applications of [¹⁴C]endosulfan to mature cucumber plants at 0.47 lb ai/A/application (~1.5X max single application). Approximately 50% of the total radioactivity was identified as α and β endosulfan and endosulfan sulfate in/on fruits. In mature cucumber leaves, 69% of the total radioactivity was identified. Residues identified were the same as those in fruits, plus sugar conjugates of endosulfan diol and hydroxy endosulfan carboxylic acid; conjugates represented more than 30% of the total residues in leaves.

In the lettuce metabolism study, the total radioactive residues (expressed as endosulfan equivalents) were 31.1-336.4 ppm in/on lettuce following the last of two foliar spray applications of [¹⁴C]endosulfan to mature lettuce plants at 1.0 lb ai/A/application (~1.0X max single application). Approximately 87% of the total radioactivity was identified with the large majority of residues consisting of the α and β isomers of endosulfan. Endosulfan sulfate and endosulfan diol were detected as minor components. Individual unidentified residues each represented less than 10% of the total radioactivity.

Based on the available metabolism data, the HED Metabolism Committee (presently referred to as the Metabolism Assessment Review Committee (MARC)) determined that tolerances **for crop and livestock commodities** should continue to be expressed as residues of the parent and the sulfate metabolite. The Committee, however, recommended that when tolerances are reassessed at reregistration, the tolerance expression should be revised to specify the α and β

isomers of the parent; the current endosulfan tolerance expression as listed in 40 CFR §180.182 does not specify the two stereo isomers of the parent compound. The chemical name and structures of endosulfan residues of concern are depicted in Figure 1. The isomers are also referred to as endosulfan I, and endosulfan II, designating the α and β isomers respectively.

Figure 1. Chemical Names and Structures of Endosulfan Residues of Concern in Plant and Animal Commodities.

Common Names Chemical Name	Structure
β-Endosulfan, Endosulfan I 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide, α isomer	
β-Endosulfan, Endosulfan II 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide, β isomer	
Endosulfan sulfate 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide	

GLN 860.1300: Nature of the Residue - Animals

The reregistration requirements for animal metabolism are fulfilled. Acceptable ruminant and poultry metabolism studies have been submitted and evaluated.

In a ruminant metabolism study, a lactating cow was orally dosed once daily with [14 C]endosulfan at approximately 22 ppm in the diet for five consecutive days. The total radioactive residues (expressed as endosulfan equivalents) were 0.17 ppm in milk, 3.57 ppm in

liver, 0.78 ppm in kidney, 0.16 ppm in heart, 0.03-0.05 ppm in muscle, and 0.30-1.28 ppm in fat. In milk, 89% of the total radioactivity was identified as endosulfan sulfate. In muscle, 66% of the total radioactivity was identified as α endosulfan and endosulfan sulfate. Although data are typically not required for heart, approximately 46% of total residues in this organ were identified as α endosulfan, endosulfan sulfate, and endosulfan lactone. In each of these tissues, individual unidentified residues each represented less than 10% of the total radioactivity and/or less than 0.05 ppm. In fat, 68% to 84% of the total radioactivity was identified as endosulfan sulfate. In liver, 52% of the total radioactivity was identified as α endosulfan, endosulfan sulfate, and probable conjugates of endosulfan or specific metabolites. In kidney, 34% of the total radioactivity was identified as the sulfate and potential conjugates of endosulfan or specific metabolites. All of the metabolites identified contained intact chlorinated rings, including all labeled carbons, even after harsh treatments to cleave conjugates indicating the stability of labeled rings.

In a poultry metabolism study, six laying hens were orally dosed once daily with [^{14}C]endosulfan at approximately 11 ppm in the diet for five consecutive days. The total radioactive residues (expressed as endosulfan equivalents) were 0.46 ppm in liver, 0.69 ppm in skin, 0.03 ppm in muscle, 0.87-0.97 ppm fat, 0.90 ppm in egg yolks, and 0.01 ppm in egg whites. Residues identified in poultry tissues ranged from 50% of the total radioactivity in muscle to 95% in fat. Residues identified included α and β endosulfan, endosulfan sulfate, endosulfan diol, endosulfan lactone, and probable conjugates of specific metabolites. In all required poultry tissues, individual unidentified residues each represented less than 10% of the total radioactivity and/or less than 0.05 ppm. Again, all of the residues identified contained intact chlorinated rings, including all labeled carbons, even after treatments to cleave conjugates.

The data were presented to the MARC on 5/1/97 (D235407, J. Abbotts) which concluded that the tolerance expression and risk assessment should include α and β endosulfan, and endosulfan sulfate.

GLN 860.1340: Residue Analytical Methods

Adequate methods are available for tolerance enforcement. The Pesticide Analytical Manual (PAM) Vol. II lists Methods I, II, and III for determination of endosulfan and/or its sulfate metabolite. Method I detects residues by microcoulometric gas chromatography. It has been determined adequate for determination of the parent and the sulfate metabolite in a variety of nonfatty foods. With Method II, sulfur dioxide is evolved into an absorbing solution, a dye reagent is added, and the solution is read in a spectrophotometer. The limit of detection is estimated at 0.1 to 0.3 ppm for endosulfan parent; the adequacy for analysis of the sulfate metabolite has not been demonstrated. Method III is a microcoulometric gas chromatography procedure for analysis of residues in milk and animal tissues. The reported limit of detection is 0.01 ppm for each endosulfan isomer and the sulfate; the method has been determined adequate for enforcement.

Samples collected from recent field and processing studies were analyzed for endosulfan residues using a GC/ECD method which is based on the published multiresidue methods. The GC/ECD method detects each of the α and β isomers of the parent and the sulfate metabolite as individual residues. The reported limit of quantitation during analyses of samples was 0.05 ppm. The method validation recoveries were generally within the range of 70-120%.

The proposed GC/ECD enforcement method (MRID 44427601) for the determination of endosulfan (α , β , and sulfate) residues in animal tissues, egg (whites and yolks) and milk was adequately validated at a limit of quantitation (LOQ) of 0.025 ppm. The method is derived from methodologies described in the Pesticide Analytical Manual (PAM 1) Sections 302, 303 and 304.

For radiovalidation; ^{14}C -treated endosulfan samples of animal tissues, egg (whites and yolks) and milk were analyzed using the proposed GC/ECD enforcement method and compared with results obtained from cow and hen metabolism studies (MRID Nos. 44082703 and 44099102; J. Abbotts, 4/2/97). Results from the GC/ECD method and those from the cow and hen metabolism study were comparable (D241269, M. Xue, 3/11/98).

Since the proposed GC/ECD enforcement method (MRID 44427601) is derived from PAM I methodology, the requirement for an independent laboratory validation and Agency validation are waived.

GLN 860.1360: Multiresidue Methods

The 2/97 FDA PESTDATA database (PAM Volume I, Appendix I) indicates that endosulfan I, endosulfan II, and endosulfan sulfate are recovered (>80%) using Multiresidue Method Sections 302 (Luke Method; Protocol D), 303 (Mills, Onley, Gaither Method; Protocol E, non-fatty foods), and Section 304 (Mills Method; Protocol E, fatty foods).

GLN 860.1380: Storage Stability Data - Plants

Fortified residues of endosulfan (α and β isomers) and endosulfan sulfate were found to be stable for at least 18 months of frozen storage in/on cantaloupe, grapes, lettuce, potato, and tomato, and in the processed commodities of grape juice, potato flakes and wet peel, tomato paste and puree, and wheat grain and wheat grain processed commodities (D249687, 12/7/98, J. Punzi; D268415, 00/00/2000, J. Punzi). These data adequately support the storage intervals and conditions of samples from previously submitted magnitude of the residue studies (D240069, 1/26/98, M. Xue).

GLN 860.1380: Storage Stability Data - Animals

The registrants have submitted the results of a 12 month storage stability study of endosulfan (α , β , and sulfate) on animal tissue and dairy matrices (D247900, 12/7/98, J. Punzi). Fortified residues of endosulfan (α and β isomers) and endosulfan sulfate were found to be stable for at least 12 months of frozen storage in beef muscle, liver, milk, and chicken egg white and egg yolk.

GLN 860.1500: Crop Field Trials

The reregistration requirements for magnitude of the residue in/on the following RACs will be considered fulfilled pending label revisions and/or tolerance adjustments: almond nutmeat and hulls; apple; apricot; barley; bean (dry and succulent); blueberry; broccoli; Brussels sprouts; cabbage; carrot; cauliflower; celery; cherry (sweet and sour); collards; corn, sweet (K + CWHR) forage and stover; cottonseed; cotton gin byproducts; cucumber; eggplant; filbert; grape; kale; lettuce (head and leaf); macadamia nut; melons (including cantaloupe, muskmelon, and watermelon); mustard greens; nectarine; oats; pea (succulent); peach; pear; pecan; pepper; pineapple; plum (fresh prune); potato; pumpkin; raspberry; rye; spinach; squash (summer and winter); strawberry; sweet potato; tea (dried leaves); tobacco; tomato; turnip (root and leaves); walnut; and wheat.

Overall, adequate field trial data depicting endosulfan residues of concern following treatments of crops using representative WP and/or EC formulations have been submitted for the RACs listed above, or have been translated where appropriate. The Agency will allow translation of residue data among morphologically related crops with similar use patterns. Translation of residue data may, however, preclude the establishment of crop group tolerances. The available data for tomato may be translated to eggplant. The available data for cucumber, melon, and summer squash may be translated to pumpkin and winter squash. The available data for peach may be translated to apricot and nectarine. The available data for almond may be translated to pecan. The available data for carrot and potato may be translated to turnip root.

Label revisions are required for some crops in order to reflect current Agency policies and/or to reflect the parameters of use patterns for which field trial data are available. Details of the required label amendments are presented in the endnotes of respective crop sections for GLN 860.1500 (Crop Field Trials) of Table 1. Refer to the "Tolerance Reassessment Summary" section for recommendations regarding appropriate tolerance levels.

The reregistration requirements for magnitude of the residue in/on the following RACs have not been fulfilled, and field trial data are required: barley flour, hay, bran and pearly barley; oat forage, hay, flour, and rolled oats; rye forage, flour, and bran; wheat forage, hay, aspirated grain fractions. Refer to Table 7 for details of reregistration requirements for the above RACs.

Endosulfan uses on the following crops are not likely to be supported by The Endosulfan Task Force members for reregistration based on notices of receipt of requests for amendments to

delete certain endosulfan uses (62 FR 6776-6777 dated 2/13/97 and 63 FR 13246-13248 dated 3/18/98): alfalfa (grown for forage), artichokes, peas (grown for seed), safflower, sugar beets, sunflower, and watercress. The agency was informed by letter dated 7/29/1997 that AgrEvo USA Company wishes to withdraw a portion of the original deletion requests and wishes to keep the uses of endosulfan on: barley, oats, rye, wheat, and beans. The Agency will recommend the revocation of established tolerances with the exception of barley, oats, rye, wheat, and beans, concomitant with the deletion of sites from all endosulfan labels. Should registrants other than the Task Force desire to support endosulfan uses on the above crops, they would be required to submit additional residue data.

Endosulfan is presently not registered by The Endosulfan Task Force members on mustard seed, raspberry, sugarcane, and watercress. The Agency will also recommend the revocation of established tolerances unless other registrants commit to support endosulfan uses on these crops and submit supporting residue data.

Tobacco uses: The use of pesticides on tobacco does not require a tolerance or an exemption from a tolerance. Nonetheless, data are needed to assess the exposure of humans to residue on tobacco. The Endosulfan Science Chapter dated 9/17/81 reported that the registered use of endosulfan on tobacco is expected to result in residues of endosulfan and endosulfan sulfate on tobacco. The Endosulfan Update dated 8/9/90 did not require additional tobacco data for the purpose of reregistration. In light of recently issued guidance on this topic (memo by M. Metzger and E. Zager dated 7/17/95), these data are inadequate to assess human exposure to endosulfan residues of concern on tobacco. The Agency will require additional confirmatory tobacco data.

GLN 860.1520: Processed Food/Feed

Acceptable processing studies have been conducted on apples, cottonseed, grapes, plums, pineapple, potatoes, and tomatoes. Residue data in/on the processed commodities of: barley (pearled barley, flour, and bran); oats (rolled oats and flour); rye (bran and flour) are required.

The apple processing data indicate that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate concentrated up to 6x in wet apple pomace and 17x in dry apple pomace processed from whole apples bearing detectable endosulfan residues; no concentration of endosulfan residues was observed in apple juice. It is noted that dry pomace has been deleted from Table 1 of OPPTS GLN 860.1000 as a significant livestock feed item.

The pineapple processing data indicate that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate concentrated up to 7x in peel and 41x in bran processed from whole pineapples bearing detectable endosulfan residues; no concentration of endosulfan residues was observed in pineapple pulp and juice. According to Table 1 of OPPTS GLN 860.1000, residue data are only required for process residue and juice. Pineapple process residue

(also known as wet bran) is a waste byproduct from the fresh-cut product line that includes pineapple tops (minus crown), bottoms, peels, any trimmings with peel cut up, and the pulp left after squeezing for juice. Pineapple process residue can also include culls.

The tomato processing data indicate that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate concentrated marginally (1.2x) in tomato paste but did not concentrate in tomato puree processed from whole tomatoes bearing detectable endosulfan residues. Refer to the "Tolerance Reassessment Summary" for appropriate recommendations and adjustments of tolerance levels, if needed, for the processed food/feed commodities of apples, pineapples, and tomatoes.

The processing studies conducted on cottonseed, grapes, and potatoes indicate that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate did not concentrate in the respective processed fractions.

GLN 860.1480: Meat, Milk, Poultry, Eggs

The reregistration requirements for animal feeding studies are fulfilled. Acceptable ruminant and poultry feeding studies have been submitted and evaluated. Based on the available metabolism data MARC has determined that tolerances in **livestock commodities** should continue to be expressed as residues of the parent and the sulfate metabolite. The Committee recommended that when tolerances are reassessed, the tolerance expression should be revised to specify the α and β isomers of the parent.

Milk, fat, meat, and meat byproducts of ruminants: There are no registered direct animal treatments for endosulfan on cattle, goats, hogs, horses, or sheep. However, endosulfan residues of concern may occur indirectly in milk and edible tissues of livestock animals as a result of ingestion of feed items such as: almond hulls, apple wet pomace, barely grain and straw, sweet corn forage and stover, cottonseed and cotton gin byproducts, pineapple process residue, oat grain and oat straw, rape forage, rye grain and straw, turnip greens, and for wheat grain and straw. The maximum theoretical dietary burdens of endosulfan to beef and dairy cattle are tentatively calculated to be 22.49 ppm and 14.80 ppm, respectively (see Table below). The dietary burden calculations are tentative because field trial data remain outstanding for a few potential feed items. Livestock feed items which are unlikely to be supported for reregistration were intentionally excluded from the calculations.

Table 2. Calculation of maximum ruminant dietary burden for endosulfan.

			Beef Cattle	Dairy Cattle
Feed Commodity	Reassessed Tolerance (ppm)	% Dry Matter		
		11		

			% of Diet	Burden (ppm)	% of Diet	Burden (ppm)
Pineapple processed residue	18.0	25	30	21.60	20	14.40
Turnip, tops	2.0	30	10	0.67	30	0.22
Wheat, grain	0.3	90	50	0.17	40	0.13
Wheat, straw	0.4	88	10	0.05	10	0.05
TOTAL			100	22.49	100	14.80

Tolerances for the combined residues of endosulfan and endosulfan sulfate have been established [40 CFR §180.182] in milk fat (negligible in whole milk) at 0.5 ppm and in the fat, meat, and meat byproducts of cattle, goats, hogs, horses, and sheep at 0.2 ppm each. These tolerances were established in conjunction with a petition (PP#8F0632) to register the use of endosulfan on alfalfa forage and hay, which are major livestock feed items but are not being supported by The Endosulfan Task Force members for reregistration.

AgrEvo USA, on behalf of The Endosulfan Task Force members, has submitted a ruminant feeding study (1999; MRID 44843702). The in-life phase of the study was conducted by AgrEvo UK Limited Development (Essex, England). Groups of three lactating dairy cows were orally dosed, twice daily at each milking period, with endosulfan at nominal rates equivalent to 4 ppm, 12 ppm, and 30 ppm for 28 consecutive days. The actual dose rates of 4 ppm, 12 ppm, and 30 ppm are, respectively, equivalent to 0.18x, 0.53x, and 1.33x the estimated maximum dietary burden of 22.49 ppm for beef cattle, or 0.27x, 0.81x, and 2.03x the estimated dietary burden of 14.80 ppm for dairy cattle. To measure the rate of residue dissipation, four additional cows in a depuration group were orally dosed with endosulfan at a nominal rate equivalent to 30 ppm for 28 days. The cows were dosed with dairy concentrate ration fortified with endosulfan in corn oil at the desired treatment rate. Fresh batches of mixes for dosing were prepared each week. Three additional cows were not treated and served as control animals.

During the dosing period, the cows were fed a dietary concentrate ration during each milking. Silage was provided at an approximate feeding rate of 16 kg/day, and water was provided *ad libitum* throughout the study. All test animals remained healthy throughout the feeding period. Information pertaining to feed consumption of test animals as well as milk production was provided. The registrant reported that average feed consumption was steady throughout the dosing period for the control as well as the treatment groups. The 30-ppm treatment group showed a small decline in feed intake; however, there was no significant weight loss over this period. There was a small decline in milk production over the course of the study, but the registrant indicated that this was not an effect of the treatment.

The cattle were milked twice daily (a.m. and p.m.). The morning and evening milk collections were refrigerated and composited the following day. Milk samples were stored frozen until analysis. Before analysis, frozen milk samples were allowed to thaw. Cream and skim milk samples were taken by pipetting from the relevant layer in the thawed milk sample. In order to spread the workload of termination, cows from the 30-ppm treatment group were sacrificed on

dose day 29, cows from the 12-ppm treatment group were sacrificed on day 31, and cows from the 4-ppm treatment group were sacrificed on day 30. In addition, cows from the depuration treatment group were sacrificed on days 36, 43, and 50. Cows were sacrificed in order of descending dosage level between 16 and 24 hours after receiving the final dose. After sacrifice, samples of liver, kidney, composite fat (omental, perirenal, and subcutaneous), and skeletal muscles (from loin, back, and diaphragm) were collected. All samples were frozen after collection and then immediately shipped to the analytical laboratory. The freezer storage intervals (from collection to residue analysis) of collected samples are indicated in parenthesis: whole milk (48-194 days), skim milk and cream (189 days), muscle (21-28 days and 201-203 days), liver (18-27 days and 201-203 days), kidney(21-23 days), and composite fat (5-8 days).

The collected samples were analyzed for residues of endosulfan (α and β isomers) and its metabolite endosulfan sulfate using the previously described GC/ECD method. The stated LOQs are 0.01 ppm for milk, muscle, liver, and kidney and 0.05 ppm for fat (for all components). Apparent residues of endosulfan (α and β isomers) and endosulfan sulfate were each below the respective LOQs in untreated whole milk (n=29 samples), skim milk (n=1), fat (n=6), kidney (n=4), liver (n=1), and muscle (n=4). One sample of untreated muscle bore detectable residues of endosulfan sulfate (0.0118 ppm) and nondetectable residues (<0.01 ppm) of endosulfan (α and β isomers). Three samples of untreated liver bore detectable residues of endosulfan sulfate (0.011-0.016 ppm) and nondetectable residues (<0.01 ppm) of endosulfan (α and β isomers). Three samples of untreated whole milk bore detectable residues of endosulfan sulfate (0.01-0.0124 ppm) and nondetectable residues (<0.01 ppm) of endosulfan (α and β isomers). One sample of untreated cream bore detectable residues of endosulfan sulfate (0.0246 ppm) and nondetectable residues (<0.01 ppm) of endosulfan (α and β isomers). The results of sample analysis from the treated dairy cows are presented in Table 3.

Table 3. Endosulfan-derived residues in dairy cow matrices following oral administration of endosulfan at 4, 12, and 30 ppm for 28 consecutive days.

Dosing or Sampling Day	Dose level (ppm)	Residues (ppm)		
		α -Endosulfan	β -Endosulfan	Endosulfan Sulfate
Milk				
-1	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01
1	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01
4	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.05, 0.07, 0.08
7	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.06, 0.06
10	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.07, 0.07
13	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.07, 0.07, 0.08
16	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.07, 0.08
19	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.07, 0.07

Dosing or Sampling Day	Dose level (ppm)	Residues (ppm)		
		α -Endosulfan	β -Endosulfan	Endosulfan Sulfate
22	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.06, 0.06
25	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.07, 0.07
28	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.05, 0.06, 0.06
-1	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01
1	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.02, 0.02, 0.02
4	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.14, 0.18, 0.28
7	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.17, 0.24, 0.28
9	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.15, 0.24, 0.30
10	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.19, 0.26, 0.35
13	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.19, 0.23, 0.40
16	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.20, 0.22, 0.31,
19	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.22, 0.22, 0.34
22	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.19, 0.23, 0.31
25	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.22, 0.24, 0.48
28	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.18, 0.24, 0.41
-1	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01
1	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.02, 0.03, 0.06
4	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.38, 0.60, 0.61
7	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.44, 0.45, 0.60
10	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.38, 0.53, 0.78
13	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.58, 0.60, 0.65
16	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.54, 0.60, 0.73
19	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.60, 0.70, 0.75
22	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.59, 0.63, 0.70
25	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.52, 0.54, 0.63
28	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.59, 0.66, 0.74
Skim Milk				
9	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.12, 0.13, 0.26
Cream				
9	12	<0.01, <0.01, <0.01	<0.01, <0.01, 0.02	0.81, 0.89, 1.4
Fat				
30	4	<0.05, <0.05, <0.05	<0.05, <0.05, <0.05	1.2, 1.4, 1.7

Dosing or Sampling Day	Dose level (ppm)	Residues (ppm)		
		α -Endosulfan	β -Endosulfan	Endosulfan Sulfate
31	12	<0.05, <0.05, <0.05	<0.05, 0.07, 0.05	2.7, 4.8, 6.7
29	30	<0.05, <0.05, <0.05	<0.05, 0.08, 0.07	7.9, 9.9, 12
Kidney				
30	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.06, 0.08, 0.08
31	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.24, 0.28, 0.40
29	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.55, 0.60, 0.85
Liver				
30	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.55, 0.59, 0.98
31	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	1.2, 2.0, 3.1
29	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	3.0, 3.7, 4.6
Muscle				
30	4	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01
31	12	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.11, 0.14, 0.45
29	30	<0.01, <0.01, <0.01	<0.01, <0.01, <0.01	0.28, 0.31, 2.0

Study summary:

The dairy cattle feeding study is acceptable. Groups of three lactating dairy cows were orally dosed with endosulfan at nominal rates equivalent to 4 ppm, 12 ppm, and 30 ppm for 28 consecutive days. The dose rates of 4 ppm, 12 ppm, and 30 ppm are, respectively, equivalent to 0.18x, 0.53x, and 1.33x the estimated maximum dietary burden of 22.49 ppm for beef cattle, and 0.27x, 0.81x, and 2.03x the estimated dietary burden of 14.80 ppm for dairy cattle. The dietary burden calculations should be considered tentative because residue field trial data remain outstanding for a few potential feed items. During the study period, milk samples were collected twice daily (a.m. and p.m.), and samples were composited the following day. At the end of the dosing period cows were sacrificed, and samples of liver, kidney, composite fat (omental, perirenal, and subcutaneous), and skeletal muscles (from loin, back, and diaphragm) were collected.

Residues of α and β isomers of endosulfan in milk and tissues, collected from the three feeding levels, were mostly below the respective LOQs. However, residues of endosulfan sulfate were significant and accounted for the major portion of total residues. At the 30-ppm feeding level (1.1x and 1.7x the estimated burdens for beef and dairy cattle, respectively), the maximum residues of endosulfan sulfate were 0.78 ppm in milk, 12 ppm in fat, 0.85 ppm in kidney, 4.6 ppm in liver, and 2.0 ppm in muscle. Residues in skim milk and cream were provided only from

the 12-ppm feeding level; the maximum residues of endosulfan sulfate at this feeding level were 0.26 ppm in skim milk and 1.4 ppm in cream.

Data from animals depurated for up to 21-22 days showed that residues of endosulfan sulfate fell significantly once dosing stopped. The maximum residues of endosulfan sulfate following oral administration of endosulfan at 30 ppm for 28 consecutive days and depuration intervals of 21-22 days were 0.04 ppm in milk, 1.3 ppm in fat, 0.06 ppm in kidney, 0.36 ppm in liver, and 0.03 ppm in muscle.

The results of the cattle feeding study reviewed herein suggest that the established animal commodity tolerances are too low. Based on the highest residues obtained in milk and tissue samples collected from the highest feeding level, the reassessed tolerances for the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows:

Fat of cattle, goats, hogs, horses, and sheep	13.0 ppm
Meat byproducts (except liver) of cattle, goats, hogs, and horses .	1.0 ppm
Liver of cattle, goats, hogs, and horses	5.0 ppm
Meat of cattle, goats, hogs, and horses	2.0 ppm
Milk, fat	2.0 ppm

Eggs, fat, meat, and meat byproducts of poultry. There are no registered direct animal treatments for endosulfan on poultry. Excluding the feed items which are not likely to be supported for reregistration, the only poultry feed items with endosulfan uses include cotton meal. The available cottonseed processing data indicate that residues of endosulfan do not concentrate in cotton meal. The field residue data indicate that the combined residues of endosulfan in/on cottonseed seed were below the respective tolerances following applications according to the maximum registered use pattern. The maximum theoretical dietary burden of endosulfan to poultry is tentatively calculated to be 0.44 ppm (see table 6 below).

Table 4. Calculation of maximum theoretical dietary burden of endosulfan to poultry.

Feed item	Reassessed Tolerance, ppm	% in Diet	Dietary burden, ppm
Cottonseed meal	1.0	20	0.20
Wheat grain	0.3	80	.24
Total		100	0.44

No endosulfan tolerances are established for eggs and poultry tissues. A poultry feeding study (1967; MRID 00003840) was evaluated in PP#8F0632. Twenty Leghorn hens were fed

technical endosulfan in their daily diet at levels of 0.3 and 3.0 ppm for seven weeks; ten additional hens served as control animals. At the end of the feeding period, the chickens were sacrificed, and eggs and tissues were collected; it could not be determined whether or not poultry eggs were collected prior to sacrifice. Sample storage conditions and intervals, prior to analyses, were not reported. Residues were determined using a microcoulometric GC method. The reported limits of detection were 0.05 ppm for the combined residues of endosulfan (α and β isomers) and 0.05 ppm for endosulfan sulfate. Method recoveries were 71-100% (average of 88%) for endosulfan and 70-89% (average of 77%) for endosulfan sulfate. The results of the poultry feeding study are presented below. One sample of cavity fat at the 3-ppm feeding level showed 0.06 ppm residues of α - and β -endosulfan; all other tissues showed nondetectable (<0.05 ppm) of α endosulfan, β endosulfan, and endosulfan sulfate.

Table 5. endosulfan-derived residues in poultry eggs and tissues following oral administration of endosulfan to laying hens at 0.3 and 3.0 ppm for seven weeks. (MRID 00003840)

Tissue	Residues, ppm		
	α -Endosulfan	β -Endosulfan	Endosulfan Sulfate
0.3 ppm-feeding level			
Eggs	<0.05		<0.05
Eggs (Unlaid)	<0.05		<0.05
Cavity fat	<0.05		<0.05
Body fat	<0.05		<0.05
Muscle	<0.05		<0.05
Hearts	<0.05		<0.05
Livers	<0.05		<0.05
Gizzards	<0.05		<0.05
Intestines	<0.05		<0.05
3.0 ppm-feeding level			
Eggs	<0.05		<0.05
Cavity fat	0.06		<0.05
Body fat	<0.05		<0.05
Muscle	<0.05		<0.05
Hearts	<0.05		<0.05
Livers	<0.05		<0.05
Gizzards	<0.05		<0.05
Intestines	<0.05		<0.05

The poultry feeding data suggest that it is not possible to establish with certainty whether finite residues of endosulfan will be incurred, but there is no reasonable expectation of finite residues (Category 3 of 40 CFR §180.6a). Therefore, tolerances are not required for eggs and poultry tissues.

GLN 860.1400: Water, Fish, and Irrigated Crops

Endosulfan is presently not registered for direct use on water and aquatic food and feed crops; therefore, no residue chemistry data are required under these guideline topics.

GLN 860.1460: Food Handling

Endosulfan is presently not registered for use in food-handling establishments; therefore, no residue chemistry data are required under this guideline topic.

GLN 860.1850 and 860.1900: Confined/Field Accumulation in Rotational Crops

An acceptable confined rotational crop study has been submitted to satisfy reregistration requirements under OPTS GLN 860.1850. The confined rotational crop study indicates that the metabolism of endosulfan in rotational crops is more extensive than that in primary crops. Radioactive residues in/on rotational commodities of lettuce, sugar beets, and wheat were determined at levels above 0.01 ppm at intervals of 29, 120, or 365 days after treatment of sandy loam soil with [¹⁴C]endosulfan at 1.1x the maximum seasonal rate. The study adequately characterized and identified residues in lettuce, sugar beet roots, sugar beet tops, wheat forage, and wheat straw. The radioactive components that were identified include endosulfan residues of concern (β -endosulfan and endosulfan sulfate) along with endosulfan diol and endosulfan lactone. The registrants have submitted limited field rotational crop studies (OPTS 860.1900 D261610, 6/15/2000, J. Punzi). The limited field trials were conducted on representative crops of the root and tuber vegetables, and small grains at three sites per crop. Samples were analyzed for residues of α - and β -endosulfan, endosulfan sulfate, endosulfan diol, and endosulfan lactone. With the exception of two straw samples (0.055-0.077 ppm) residues of each analyte were <0.05 ppm. These data indicate that tolerances for residues of endosulfan in rotational crops will not be required provided that the labels are amended to specify a rotational crop restriction of at least 30 days. As the registrant is continuing to support registered use on small grains, tolerances on these commodities will adequately cover inadvertent endosulfan residues which may appear in rotational small grains.

Presently, a restriction against planting of root crops other than carrots, potatoes, sweet potatoes, and sugar beets as follow-up crops is specified on the labels for the following products: EPA Reg. Nos. 279-1380, 279-2659, 279-2735, 279-2822, 279-2924, 279-3129, 45639-169, 45639-194, 45639-197, 45639-198, and 66222-2. No other rotational crop restrictions have been established.

Table 6. Food/Feed Use Patterns on EP Labels Subject to Reregistration for Endosulfan.

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Alfalfa (grown for seed)						
Foliar treatment Ground or aerial	3 lb/gal EC [CA860035]	1.0 lb/A	2	Not specified (NS)	21	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 5 gal/A by air. The feeding or grazing of treated foliage, crop residues, or seed millings and the use of treated seed for livestock food or feed are prohibited.
	3 lb/gal EC [NV860005]	1.0 lb/A	3	NS	NS	Use limited to NV. Applications may be made in a minimum of 10 gal/A by ground or 2 gal/A by air. The feeding or grazing of treated foliage, crop residues, or seed millings and the use of treated seed for livestock food or feed are prohibited.
	3 lb/gal EC [WA880012]	0.5 lb/A	2	NS	21	Use limited to WA. Applications may be made in a minimum of 25 gal/A by ground or 10 gal/A by air. The feeding or grazing of treated foliage, crop residues, or seed screenings is prohibited.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Almond						
Delayed dormant or foliar (during popcorn, pink, or petal fall) Ground or aerial	2 lb/gal EC [279-2659]	2.5 lb/A	1	2.5 lb/A	NS	Application may be made in a minimum of 200 gal of water/A (dilute) or 40 gal of water/A (concentrate). The grazing of livestock on orchard crops or grasses in treated areas is prohibited*. Treated hulls may be fed to livestock and dairy animals.
Apple						
Delayed dormant and/or foliar (during pink and/or petal fall) Ground or aerial	50% WP [279-1380] [279-3129] [45639-194] [66222-2] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.5 lb/100 gal or 2.5 lb/A	3 (2 per fruiting period)	3.0 lb/A	21	A second application may be made 10 days later. The feeding of pomace from treated apples to livestock, the feeding of cull fruits to animals, or allowing livestock to graze in treated orchards is prohibited.*
Foliar treatment Ground or aerial	50% WP [45639-198]	0.5 lb/100 gal or 2.5 lb/A	3 (2 per fruiting period)	3.0 lb/A	30	Use limited to CA. The feeding of pomace from treated apples to livestock, the feeding of cull fruits to animals, or allowing livestock to graze in treated orchards is prohibited.*
	3 lb/gal EC [45639-197]	0.5 lb/100 gal or 2.5 lb/A	2	3.0 lb/A	30	
Foliar treatment Aerial	50% WP [WA780033]	1.5 lb/A	NS	NS	NS	Use limited to WA. Applications may be made in a minimum of 3 gal of water/A using aerial equipment.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Apricot						
Bark treatment Postharvest Ground	50% WP [279-1380] [279-3129] [45639-194] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.75 lb/100 gal (Pacific Northwest) 2.5 lb/100 gal (Southeastern states)	2	3.0 lb/A	21	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*
	50% WP [66222-2]	0.75 lb/100 gal (West coast) 2.5 lb/100 gal (Southeastern states)	2	3.0 lb/A	21	
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	30	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited. * Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Barley						
Foliar treatment Ground or aerial	50% WP [279-1380] [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.5 lb/A	2	1.0 lb/A	NS	Applications may be made in a minimum of 10 gal of water/A using ground equipment. For control of army cutworm, aerial applications may be made in a minimum of 2 gal of crop oil, diesel oil, or water/A. Use limited to IL, IN, MI, and OH for control of cereal leaf beetle, aerial applications may be made in a minimum of 1 gal of water/A. The feeding of treated forage to livestock and application after heads begin to form are prohibited. *
	50% WP [279-1380] [279-3129] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb/A	2	1.0 lb/A	NS	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of treated forage to livestock and application after heads begin to form are prohibited.* Use of the 3 lb/gal EC (EPA Reg. No. 45639-197) formulation is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Bean, succulent and dry						
Foliar treatment Ground or aerial	50% WP [279-1380] [279-3129] [45639-194] [45639-198] [66222-22]	1.0 lb/A	3	3.0 lb/A	3	Applications may be made in a minimum of 10-25 gal/A by ground or 1 gal/A by air with a 5-day retreatment interval. No retreatment interval is specified of the 50% WP (EPA Reg. No. 45639-198). The feeding of treated threshings or allowing livestock to graze in treated fields is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	2 lb/gal EC [279-2659] [279-2735] [279-2822]					
	3 lb/gal EC [279-2924] [45639-169] [45639-197]					
	3 lb/gal EC [279-3222]	1.0 lb/A	3	3.0 lb/A	21	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of treated threshings or allowing livestock to graze in treated fields is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Blueberry						
Postharvest treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.5 lb/A	2	3.0 lb/A	NS	Applications may be made after harvest in 3 lbai/300 gal of water with a 6- to 8-week retreatment interval. Application after buds are well formed is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Broccoli						
Foliar treatment Ground or aerial	50% WP [45639-194] [66222-22] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	4	3.0 lb/A	7	Applications may be made in a minimum of 10 gal/A by ground or 1-3 gal/A by air.
	50% WP [279-3129]	1.0 lb/A	3	3.0 lb/A	7	For use on broccoli, including Chinese broccoli. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	2	2.0 lb/A	7	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
Broccoli (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	Use limited to OR and WA. Applications may be made in a minimum of 20 gal/A by ground or 5 gal/A by air. Use of treated crops or crop residue or sweepings for food or feed and the grazing of livestock on treated areas are prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Brussels sprouts						
Foliar treatment Ground or aerial	50% WP [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2735] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	4	3.0 lb/A	14	Applications may be made in a minimum of 10-25 gal/A by ground or 1-3 gal/A by air.
	50% WP [279-3129]	1.0 lb/A	3	3.0 lb/A	14	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	2	2.0 lb/A	14	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Cabbage						
Foliar treatment Ground or aerial	50% WP [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2735] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	4	3.0 lb/A	7	See "Brussels sprouts".
	50% WP [279-3129]	1.0 lb/A	3	3.0 lb/A	7	For use on cabbage, including Chinese cabbage or Napa. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	2	2.0 lb/A	7	See "Brussels sprouts".
	3 lb/gal EC [279-3222]	0.75 lb/A	2	1.5 lb/A	14	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Cabbage (grown for seed)						
Foliar treatment Ground or aerial	3 lb/gal EC [WA760012]	2.0 lb/A	2	NS	NS	Use limited to WA. Applications may be made in a minimum of 20 gal/A by ground or 5 gal/A by air. The grazing of livestock in treated areas and the use of treated crop or crop residue or screenings for food or feed are prohibited.*
	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	Use limited to OR and WA on cabbage including Chinese cabbage. Applications may be made in a minimum of 20 gal/A by ground or 5 gal/A by air. Use of treated crops or crop residue or sweepings for food or feed and the grazing of livestock on treated areas are prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Carrot						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22]	1.0 lb/A	1	1.0 lb/A	7	Applications may be made in a minimum of 10-25 gal/A by ground or 1 gal/A by air. Use of tops for food or feed is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	2 lb/gal EC [279-2659] [279-2735] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]					

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Carrot (continued)						
Foliar treatment Ground or aerial	3 lb/gal EC [279-2149]	1.0 lb/A	1	1.0 lb/A	15	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of tops for food or feed is prohibited.*
Cauliflower						
Foliar treatment Ground or aerial	50% WP [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2735] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	4	3.0 lb/A	14	See "Brussels sprouts".
	50% WP [279-3129]	1.0 lb/A	3	3.0 lb/A	14	See "Brussels sprouts".
	3 lb/gal EC [279-2149]	0.75 lb/A	2	1.5 lb/A	14	See "Brussels sprouts".
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	2	2.0 lb/A	14	See "Brussels sprouts".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Celery						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	1	1.0 lb/A	4	Application may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/A	2	1.0 lb/A	7	Application may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Cherry						
Bark treatment Ground	50% WP [279-3129] 3 lb/gal EC [279-2924]	0.75 lb/100 gal	2	3.0 lb/A	21	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Cherry (continued)						
Bark treatment Postharvest Ground	50% WP [45639-194] [66222-22] 3 lb/gal EC [45639-169]	0.75 lb/100 gal	2	3.0 lb/A	21	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*
Delayed dormant (popcorn or prepink stage) Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	21	Use limited to Pacific Northwest. The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Delayed dormant Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/100 gal	2	3.0 lb/A	21	Use limited to MI. The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Cherry (continued)						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	21	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited. * Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Nursery stock dip	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	2 lb/40 gal	NS	NS	Not applicable (NA)	Immerse trees so that the roots and crowns are covered well above the grafting bud scar; plant immediately or dry before returning to storage. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Citrus (nonbearing trees and nursery stock)						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822]	0.25 lb/100 2.5 lb/A	2	3.0 lb/A	NS	Application to bearing trees or trees that will bear fruit within 12 months is prohibited. Use of the 50% WP (EPA Reg. No. 45639-198) formulation is limited to CA.
	3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 2.5 lb/A	2	3.0 lb/A	NS	Application to bearing trees or trees that will bear fruit within 12 months is prohibited. Use of the 3 lb/gal EC (EPA Reg. No. 45639-197) formulation is limited to CA.
Clover (grown for seed)						
Foliar treatment Ground or aerial	3 lb/gal EC [CA900031]	0.5 lb/A	2	NS	NA	Use limited to CA. Applications may be made in a minimum of 20 gal/A by ground or 10 gal/A by air. The use of crop refuse as food or feed for livestock is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Collards						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22]	1.0 lb/A	1	1.0 lb/A	21	Application may be made in a minimum of 10-25 gal/A by ground or 1 gal/A by air.
	2 lb/gal EC [279-2659] [279-2735] [279-2822]					
	3 lb/gal EC [279-2924] [45639-169]					
	50% WP [45639-198] 3 lb/gal EC [45639-197]	0.75 lb/A	1	0.75 lb/A	21	Use limited to CA. Application may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
Collards (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	See "Broccoli".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Corn, sweet						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.5 lb/A	3	3.0 lb/A	1	Use limited to fresh vegetable; application to sweet corn to be processed is prohibited.* Applications may be made in a minimum of 10 gal/A by ground or 1-5 gal/A by air with a 5-day retreatment interval. The feeding of treated forage or ensilage to livestock or the grazing of livestock in treated fields is prohibited.* Use of the 3 lb/gal EC (EPA Reg. No. 45639-197) is limited to CA.
Cotton						
Foliar treatment (until bolls open) Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.5 lb/A	NS	3.0 lb/A	NS	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The grazing of dairy or meat animals in treated fields and application after bolls open are prohibited.* Use of the 3 lb/gal EC (EPA Reg. No. 45639-197) is limited to CA.
	3 lb/gal EC [279-2149] [279-3222]	1.5 lb/A	2	3.0 lb/A	NS	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The grazing of dairy or meat animals in treated fields and application after bolls open are prohibited.*
Cotton (continued)						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment (after bolls open) Ground or aerial	2 lb/gal EC [AZ930014] [AZ930016]	0.75 lb/A	NS	3.0 lb/A	14	Use limited to AZ. Applications may be made in a minimum of 10 gal/A using ground or aerial equipment.
Cucumber						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	6	3.0 lb/A	2	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	3	3.0 lb/A	2	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Eggplant						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	2	1.0 lb/A	1	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	3 lb/gal EC [45639-197]	0.5 lb/A	2	0.5 lb/A	1	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198]	0.5 lb/A	1	0.5 lb/A	1	Use limited to CA. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
Filbert						
Foliar treatment Ground or aerial	50% WP [279-1380] [279-3129] [45639-194] [45639-198] [66222-22]	0.5 lb/100 gal 2.0 lb/A	2	3.0 lb/A	1	The grazing of livestock on orchard crops or grasses in treated areas is prohibited. * Use of the 50% WP (EPA Reg. No. 45639-198) formulation is limited to CA.
	50% WP [OR780020]	0.5 lb/100 gal (300 gal/A; dilute) 1.5 lb/A (25 gal/A; concentrate)	NS	NS	NS	Use limited to OR. Application may be made in a minimum of 300 gal of water/A (dilute) or in 25 gal of water/A (concentrate). The grazing of livestock in treated groves is prohibited.* No PHI has been established.
Grape						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground (preferred)	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 1.5 lb/A	3	3.0 lb/A	7	Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Foliar treatment Ground	3 lb/gal EC [CA760115]	1.0 lb/A	NS	NS	7	Use limited to CA. Applications may be made in a minimum of 45 gal of water/A using ground equipment.
Kale						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb/A	1	0.75 lb/A	21	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Kale (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	See "Broccoli".
Kohlrabi (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	See "Broccoli".
Lettuce, head						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	3 (after thinning)	3.0 lb/A	14	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of crop refuse to livestock is prohibited. * Remove wrapper leaves at harvest.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Lettuce, leaf						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	2	3.0 lb/A	14	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of crop refuse to livestock is prohibited. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Macadamia nut						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground or aerial	2 lb/gal EC [279-2659] [279-2822]	1.0 lb/100 gal	NS	3.0 lb/A	1	The grazing of livestock on orchard crops or grasses in treated areas is prohibited.
Foliar treatment Ground	50% WP [HI880008]	1.0 lb/100 gal	NS	6.0 lb/A	2	Use limited to HI. The grazing of livestock on orchard crops or grasses in treated areas.* Application by aircraft is prohibited.
Melons						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22]	1.0 lb/A	6	3.0 lb/A	2	See "Cucumber".
	2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169]					
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	3	3.0 lb/A	2	See "Cucumber".
Mustard greens						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	1	1.0 lb/A	21	Application may be made in a minimum of 10 gal/A by ground or 1 gal/A by air.
Mustard greens (continued)						
Foliar treatment Ground or aerial	50% WP [45639-198] 3 lb/gal EC [45639-197]	0.75 lb/A	1	0.75 lb/A	21	Application may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	50% WP [WA780029] 3 lb/gal EC [OR770043]	2.0 lb/A	2	NS	NS	See "Broccoli".
Nectarine						

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Bark treatment Postharvest Ground	50% WP [279-3129] [45639-194] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.75 lb/100 gal (Pacific Northwest) 2.5 lb/100 gal (Southeastern states)	2	3.0 lb/A	21	See "Apricot".
	50% WP [279-1380] [66222-22]	0.75 lb/100 gal (West coast) 2.5 lb/100 gal (Southeastern states)	2	3.0 lb/A	21	See "Apricot".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	30	See "Apricot".
Oats						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924]	0.5 lb ai/A	2	1.0 lb/A	NS	See "Barley".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Oats (continued)						
Peach (continued)						
Nursery stock dip	50% WP [27-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	2 lb/40 gal	NS	NS	NA	See "Cherry".
Foliar treatment Ground or aerial	50% WP [279-3129] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb/A	2	1.0 lb/A	NS	See "Barley".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Pear						
Delayed dormant and foliar (during white bud or petal fall) Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	2.5 lb/A	2	3.0 lb/A	7	Application may be made in a minimum of 10-20 gal of water/A by air, in 40 gal (semi-concentrate), or in 300 gal (dilute). The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited. * Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	2 lb/gal EC [279-2822]	0.75 lb/100 gal [300 gal of finished spray/A]	2	3.0 lb/A	7	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Pear (continued)						
Soil treatment Prebloom Ground	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal [200-400 gal of finished spray/A]	2	3.0 lb/A	7	Applications may be made to the orchard floor. The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited. * Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Postharvest or dormant Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal	2	3.0 lb/A	7	The feeding of cull fruits to animals or allowing livestock to graze in treated orchards is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Peas, succulent (including black-eyed peas, crowder peas, and southern peas)						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	3	3.0 lb/A	3	See "Bean, succulent and dry".
	2 lb/gal EC [279-2659] [279-2822]	1.0 lb/A	3	2.0 lb/A	1	Use limited to the Northwest (EPA Reg. No. 279-2659). Use limited on peas to be harvested by combine only. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of treated vines or threshings to livestock or allowing livestock to graze in treated fields is prohibited. *

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Peas, succulent (including black-eyed peas, crowder peas, and southern peas)(continued)						
Foliar treatment Ground or aerial						
	3 lb/gal EC [279-2924]	1.0 lb/A	2 per fruiting period	2.0 lb/A	5	Use limited on peas to be harvested by combine only. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of treated vines or threshings to livestock or allowing livestock to graze in treated fields is prohibited.*
	3 lb/gal EC [WI920007]	1.0 lb/A	2 per fruiting period	3.0 lb/A	NS	Use limited to WI on peas to be harvested by combine only. Applications may be made in a minimum of 10 gal/A by ground or 2 gal/A by air. The grazing of treated fields or the feeding of treated forage or threshings to livestock is prohibited.*
Peas (seed crop)						
Foliar treatment Ground or aerial	50% WP [66222-22] 3 lb/gal EC [279-2924]	1.0 lb/A	2	1.5 lb/A	1	Use limited on peas to be harvested by combine only. Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The feeding of treated vines or threshings to livestock or allowing livestock to graze in treated fields is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Pecan						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb/100 gal	2	3.0 lb/A	NS	The grazing of livestock on orchard crops or grasses in treated areas and application after shuck split are prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Pepper						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/A	2	1.0 lb/A	1	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Pepper (continued)						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	2	2.0 lb/A	4	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Pineapple (for fresh market only)						
Foliar treatment Ground or aerial	50% WP [279-3129] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-197]	2.0 lb/A	2	3.0 lb/A	7	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air with a 7- to 10-day retreatment interval. The feeding of treated forage or pineapple byproducts to livestock is prohibited.* Use of the 3 lb/gal EC (EPA Reg. No. 45639-197) is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Plum						
Delayed dormant (during pre-pink stage) Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	Use limited to the Pacific Northwest. The grazing of livestock on treated orchard crops or grasses in treated areas is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639- 197) formulations is limited to CA.
Prebloom or foliar (petal fall) Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	The grazing of livestock on treated orchard crops or grasses in treated areas is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639- 197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Plum (continued)						
Foliar treatment Ground or aerial	50% WP [45639-194] [45639-198]	0.75 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	The grazing of livestock on treated orchard crops or grasses in treated areas is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) formulation is limited to CA.
Bark treatment Postharvest Ground	50% WP [279-3129] [45639-194] [45639-198] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [45639-169] [45639-197]	0.75 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	The grazing of livestock on treated orchard crops or grasses in treated areas is prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Bark treatment Ground	50% WP [66222-22] 3 lb/gal EC [279-2924]	0.75 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	The grazing of livestock on treated orchard crops or grasses in treated areas is prohibited.*

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Plum (continued)						
Nursery stock dip	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	2 lb/40 gal	NS	NS	NA	See "Cherry".
Potato						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A	6	3.0 lb/A	1	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Chemigation Sprinkler irrigation	3 lb/gal EC [WA900023]	1.0 lb/A	NS	3.0 lb/A	1	Use limited to WA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Prune						
Delayed dormant (during pre-pink stage) Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	See "Plum".
Prebloom or foliar (petal fall) Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.5 lb/100 gal 2.5 lb/A	2	3.0 lb/A	7	See "Plum".

Table 6 (continued).

Table 6 (continued)						
Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Prune (continued)						
Bark treatment Postharvest Ground	50% WP [279-3129] [45639-194] [45639-198]	0.75 lb/100 gal	2	3.0 lb/A	7	See "Plum".
	2 lb/gal EC [279-2659] [279-2822]	2.5 lb/A				
	3 lb/gal EC [45639-169] [45639-197]					
Bark treatment Ground	50% WP [66222-22]	0.75 lb/100 gal	2	3.0 lb/A	7	See "Plum".
	3 lb/gal EC [279-2924]	2.5 lb/A				
Pumpkin						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	6	3.0 lb/A	2	See "Cucumber".
	3 lb/gal EC [45639-197]	1.0 lb/A	3	3.0 lb/A	2	See "Cucumber".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Radish (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	See "Broccoli".
Rutabaga (grown for seed)						
Foliar treatment Ground or aerial	50% WP [WA780029] 3 lb/gal EC [OR770043] [WA770016]	2.0 lb/A	2	NS	NS	See "Broccoli".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Rye						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924]	0.5 lb/A	2	1.0 lb/A	NS	See "Barley".
	50% WP [279-3129] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb/A	2	1.0 lb/A	NS	See "Barley".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Spinach						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2735] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	1	1.0 lb/A	21	Applications may be made in a minimum of 10-25 gal/A by ground or 1 gal/A by air.
	50% WP [45639-198] 3 lb/gal EC [45639-197]	0.75 lb/A	1	0.75 lb/A	21	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Squash, summer and winter						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	6	3.0 lb/A	2	See "Cucumber".
	50% WP [45639-198] 3 lb/gal EC [45639-197]	1.0 lb/A	3	3.0 lb/A	2	See "Cucumber".

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Strawberry						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22]	1.0 lb/A	3	3.0 lb/A	4	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Do not reapply within 15 days or more than twice during a 35 day period when fruit is present. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
	2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	2.0 lb/A	3	3.0 lb/A	4	Applications may be made in 400 gal. Do not apply at intervals less than 35 days when fruit is present. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.
Dip treatment	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/100 gal	NS	NS	NA	Use limited to Northwest. Immerse bundles of plants; drain and allow plants to dry before setting them out in the field. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Sweet potato						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A	3	3.0 lb/A	1	The feeding of cull potatoes to livestock or the grazing of livestock in treated fields is prohibited.*
	50% WP [45639-198] 3 lb/gal EC [45639-197]	0.5 lb/A	3	0.75 lb/A	1	Use limited to CA. The feeding of cull potatoes to livestock or the grazing of livestock in treated fields is prohibited.*
	50% WP [MS810036] 3 lb/gal EC [MS810035]	0.5 lb/A	NS	NS	NS	Use limited to MS. The feeding of treated potatoes to livestock is prohibited. *

Table 6 (continued).

Table 6 (continued):

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Sweet potato (continued)						
Soil band or broadcast Ground or aerial	50% WP [279-3129] [66222-22] 3 lb/gal EC [279-2924] [45636-169]	2.0 lb/A (broadcast) 0.67-0.75 lb/A based on a 16 inch band with a 48 inch row spacing	3	3.0 lb/A	1	Use limited to South central states and PR. The feeding of cull potatoes to livestock or the grazing of livestock in treated fields is prohibited.*
Soil treatment Ground or aerial	50% WP [MS8100036]	2.0 lb/A	NS	NS	NS	Use limited to MS. The feeding of treated potatoes to livestock is prohibited.*
	3 lb/gal EC [MS810035]	1.5 lb/A	NS	NS	NS	
Tobacco						
Foliar treatment Seed bed Ground	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.5 lb/100 gal [6 gal of finished spray/100 sq. yd]	6	3.0 lb/A	5	

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Tobacco (continued)						
Drench treatment Plant bed Ground	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924] [45639-169]	0.25 lb/100 gal [1 gal of finished spray/sq. yd]	6	3.0 lb/A	5	
Foliar treatment Field Ground	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822]	1.0 lb/A 1.5 lb/100 gal	6	3.0 lb/A	5	
	3 lb/gal EC [279-2924] [45639-169]	1.0 lb/A 0.5 lb/100 gal	6	3.0 lb/A	5	

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Tomato (field)						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22] 2 lb/gal EC [279-2659] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	1.0 lb/A 0.5 lb/100-200 gal	6	3.0 lb/A	2	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Use of the 50% WP (EPA Reg. No. 45639-198) and the 3 lb/gal EC (EPA Reg. No. 45639-197) formulations is limited to CA.

Table 6 (continued).

Table 3 (Continued)						
Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Turnip						
Foliar treatment Ground or aerial	2 lb/gal EC [279-2659] [279-2822]	0.75 lb/A	1	0.75 lb/A	21	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. Application to turnips grown for roots is prohibited.*
Walnut						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [45639-198] [66222-22]	2.0 lb/A	2	3.0 lb/A	NS	Applications may be made in a minimum of 10 gal/A by ground or 1 gal/A by air. The grazing of livestock on orchard crops or grasses in treated areas and application after husk split are prohibited.* Use of the 50% WP (EPA Reg. No. 45639-198) formulation is limited to CA.
	2 lb/gal EC [279-2659] [279-2822]					
	3 lb/gal EC [279-2924] [45639-169]	2.5 lb/A	2	3.0 lb/A	NS	

Table 6 (continued).

Site Application Type Application Timing Application Equipment	Formulation [EPA Reg. No.] ¹	Maximum Single Application Rate (ai)	Maximum Number of Applications Per Season	Maximum Seasonal Rate (ai)	Preharvest Interval, (Days)	Use Directions and Limitations ¹
Wheat						
Foliar treatment Ground or aerial	50% WP [279-3129] [45639-194] [66222-22] 2 lb/gal EC [279-2659] [279-2822] 3 lb/gal EC [279-2924]	0.5 lb ai/A	2	1.0 lb/A	NS	See "Barley".
Foliar treatment Ground or aerial	50% WP [279-3129] [66222-22] 3 lb/gal EC [279-2924] [45639-169] [45639-197]	0.75 lb ai/A	2	1.0 lb/A	NS	See "Barley".

¹ A restriction against planting of root crops other than carrots, potatoes, sweet potatoes, and sugar beets as rotational crops is specified on the labels for the following endosulfan products: EPA Reg. Nos. 279-1380, 279-2659, 279-2735, 279-2822, 279-2924, 279-3129, 45639-169, 45639-194, 45639-197, 45639-198, and 66222-2.

C Label restrictions against; feeding cull fruits to livestock, prohibiting grazing of livestock in treated areas, and certain application timings may be considered inappropriate since they are not practical or enforceable.

Table 7. Residue Chemistry Science Assessments for Reregistration of Endosulfan.

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
860.1200: Directions for Use	N/A = Not Applicable	Yes ²	
860.1300: Plant Metabolism	N/A	No	00003600, 00003642, 00003654, 05002565, 05003004, 05003085, 05003336, 05003801, 05004385, 05004620, 05018169, 44082701 ³ , 44082702 ³ , 44099101 ³
860.1300: Animal Metabolism	N/A	No	00003742, 00003743, 00003838, 00003840, 05003222, 05003877, 44082703 ³ , 44099102 ³
860.1340: Residue Analytical Methods			
- Plant commodities	N/A	No	00003588, 00003612, 00003795, 00003959, 05003395, GS014024, 00146842, 00157147, 00157148, 44346902 ⁴
- Animal commodities	N/A	No	00003703, 00003840
860.1360: Multiresidue Methods	N/A	No	44427601
860.1380: Storage Stability Data			
- Plant commodities	N/A	No	44396301
- Animal commodities	N/A	No	44854101, 44854102, 44854103, 44843702
860.1500: Crop Field Trials			
<u>Root and Tuber Vegetables Group</u>			
- Beet, sugar, roots	0.1 [§180.182]	No ⁵	00003728, 00003730

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Carrot	0.2 [§180.182]	No	00003796
- Potato	0.2 [§180.182]	No	00003709
- Radish (grown for seed)	None established	No ⁶	
- Rutabaga (grown for seed)	None established	No ⁶	
- Sweet potato	0.2 [§180.182]	No	00003642, 00003669, 44346912 ⁴
- Turnip, roots	None established	No ⁷	
- Turnip (grown for seed)	None established	No ⁶	
<u>Leaves of Root and Tuber Vegetables Group</u>			
- Beet, sugar, tops	None established	No ⁵	00003728, 00003730
- Turnip, tops	2.0 [§180.182]	No ⁸	00003796
<u>Leafy Vegetables (except <i>Brassica</i>) Vegetables Group</u>			
- Celery	2.0 [§180.182]	No	00003796, 44346906 ⁴ 44701201 ³⁵
- Lettuce	2.0 [§180.182]	No	00003722, 00003790, 44346904 ⁴ , 44701202 ³⁵

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Spinach	2.0 [§180.182]	No	00003796
<i><u>Brassica (Cole) Vegetables Group</u></i>			
- Broccoli	2.0 [§180.182]	No	00003796, 44346908 ⁴
- Broccoli (grown for seed)	2.0 [§180.182]	No ⁶	
- Brussels sprouts	2.0 [§180.182]	No	00003796
- Cabbage	2.0 [§180.182]	No	00003790
- Cabbage (grown for seed)	2.0 [§180.182]	No ⁶	
- Cauliflower	2.0 [§180.182]	No	00003796
- Collards	2.0 [§180.182]	No ⁹	00003796
- Collards (grown for seed)	2.0 [§180.182]	No ⁶	
- Kale	2.0 [§180.182]	No	00003796
- Kale (grown for seed)	2.0 [§180.182]	No ⁶	
- Kohlrabi (grown for seed)	None established	No ⁶	

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Mustard greens	2.0 [§180.182]	No ¹⁰	00003796
<u>Legume Vegetables Group</u>			
- Bean, dry and succulent	2.0 [§180.182]	No ¹¹	00003796
- Pea, succulent	2.0, succulent [§180.182]	No	00003917, 00003949
- Pea (grown for seed)	None established [§180.182]	No ⁵	00003917, 00003949
<u>Fruiting Vegetables (Except Cucurbits) Group</u>			
- Eggplant	2.0 [§180.182]	No ¹²	
- Pepper	2.0 [§180.182]	No	00003864
- Tomato	2.0 [§180.182]	No	00003783, 00146842 , 44346905 ⁴
<u>Cucurbit Vegetables Group</u>			
- Cucumber	2.0 [§180.182]	No	00146842 , 44346909 ⁴
- Melon (including cantaloupe, muskmelon, and watermelon)	2.0 [§180.182]	No	00146842 , 44346903 ⁴
- Pumpkin	2.0 [§180.182]	No ^{12b}	
- Squash, summer	2.0 [§180.182]	No	00146842 , 44346907 ⁴

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Squash, winter	2.0 [§180.182]	No ^{12b}	
<u>Citrus Fruits Group</u>			
- Citrus (nonbearing trees and nursery stock)	None established	No ¹³	
<u>Pome Fruits Group</u>			
- Apple	2.0 [§180.182]	No	00003787
- Pear	2.0 [§180.182]	No	00003862
<u>Stone Fruits Group</u>			
- Apricot	2.0 [§180.182]	No ^{12c}	
- Cherry	2.0 [§180.182]	No	00003782, 44346910 ⁴ , 44346911 ⁴
- Nectarine	2.0 [§180.182]	No ^{12c}	
- Peach	2.0 [§180.182]	No	00003784, 00003789
- Plum (fresh prune)	2.0 [§180.182]	No	00003786, 00003791
<u>Berries Group</u>			
- Blueberry	0.1 [§180.182]	No	00003587, 00003843

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Raspberry	0.1 [§180.182]	No ¹⁴	00138256 ¹⁵
<u>Tree Nuts Group</u>			
- Almond, nutmeat and hulls	0.2, almonds; 1.0, almonds, hulls [§180.182]	No ¹⁶	00003713, 00004254
- Filbert	0.2 [§180.182]	No ¹⁷	00004254
- Macadamia nut	0.2 [§180.182]	No	00004254
- Pecan	0.2 [§180.182]	No ¹⁸	
- Walnut	0.2 [§180.182]	No ¹⁹	00004254
<u>Cereal Grains Group</u>			
- Barley, grain	0.1, grain [§180.182]	Yes ⁸	00003710
- Corn, sweet, K+CWHR	0.2, sweet (K+CWHR) [§180.182]	No ²⁰	00003634, 00003760, 44457001 ²¹
- Oats, grain	0.1, grain [§180.182]	Yes ²⁷	00003710
- Rye, grain	0.1, grain [§180.182]	Yes ²⁷	00003710
- Wheat, grain and aspirated grain fractions	0.1, grain [§180.182]	Yes ²⁷	00003710, 44762901
<u>Forage, Fodder, and Straw of Cereal Grains Group</u>			

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Barley, hay and straw	0.2, straw [§180.182]	Yes ²⁷	00003710
- Corn, sweet, forage and stover	None established	Yes ²²	44457001 ²⁴
- Oats, forage, hay, and straw	0.2, straw [§180.182]	Yes ²⁷	00003710
- Rye, forage and straw	0.2, straw [§180.182]	Yes ²⁷	00003710
- Wheat, forage, hay, and straw	0.2, straw [§180.182]	Yes ²⁷	00003710, 44762901
<u>Non-grass Animal Feeds (Forage, Fodder, Straw, and Hay) Group</u>			
- Alfalfa, forage and hay	0.3, fresh; 1.0, hay [§180.182]	No ⁵	00003834, 00003835, 00003836, 00003841, 00004258, 00157148 ²³
- Alfalfa (grown for seed)	None established	No ²⁴	
- Clover (grown for seed)	None established	No ²⁵	
<u>Herbs and Spices Group</u>			
- Mustard seed	0.2 [§180.182]	No ¹⁴	00003724
<u>Miscellaneous Commodities</u>			
- Artichoke	2.0 [§180.182]	No ⁵	
- Cotton, seed and gin byproducts	1.0, cottonseed [§180.182]	No	00003725, 00003777, 44854101, 44854102, 44854103
- Grape	2.0 [§180.182]	No	00003788

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Pineapple	2.0 [§180.182]	No	00003797, 00003798, 00003799
- Rape, seed and forage	0.20, seed [§180.182]	No ⁵	00003724
- Safflower	0.2 [§180.182]	No ⁵	00003727
- Strawberry	2.0 [§180.182]	No	00003785
- Sugarcane	0.5 [§180.182]	No ⁵	00003676, 00003901
- Sunflower	2.0 [§180.182]	No ⁵	00003796
- Tea, dried leaves	24 (reflecting <0.1 ppm residues in beverage tea) [§185.2600]	No	00003744, 00003756
- Tobacco	None established	Yes	05003004, 05003801
- Watercress	2.0 [§180.182]	No ⁵	00003796
860.1520: Processed Food/Feed			
- Apple	None established	No	00156259
- Barley	None established	Yes ²⁷	
- Beet, sugar	None established	No ⁵	
- Cotton, seed	None established	No ³⁶	00003726
- Grape	None established	No	00156259 , 44346915 ⁴

GLN: Data Requirements	Current Tolerances, ppm [40 CFR]	Must Additional Data Be Submitted?	References ¹
- Oats	None established	Yes ²⁷	
- Pineapple	None established	No	00157147
- Plum	None established	No	
- Potato	None established	No	44346913 ⁴
- Rape	None established	No ⁵	
- Rye	None established	Yes ²⁷	
- Safflower	None established	No ⁵	
- Sunflower	None established	No ⁵	
- Tomato	None established	No	00146842 , 44346914 ⁴
- Wheat	None established	Yes ²⁷	
860.1480: Meat, Milk, Poultry, Eggs			
- Milk and the Fat, Meat, and Meat Byproducts of Cattle, Goats, Hogs, Horses, and Sheep	0.2, fat, meat, and meat byproducts; 0.5, milk, fat (=N in whole milk)	No	00003742, 00003743, 00003838, 05003222, 05003877, 05013696
- Eggs and the Fat, Meat, and Meat Byproducts of Poultry	None established	No	00003840
860.1400: Water, Fish, and Irrigated Crops	N/A	N/A	
860.1460: Food Handling	N/A	N/A	
860.1850: Confined Rotational Crops	N/A	No	44393001
860.1900: Field Rotational Crops	None established	No	44972301

1. **Bolded** references were reviewed in the Residue Chemistry Chapter of the Endosulfan Reregistration Standard Update dated 8/9/90. Unbolded references were reviewed in the Residue Chemistry Chapter of the Endosulfan Reregistration Standard dated 1/16/82. All other references were reviewed as noted.
2. Label revisions are required for many crops in order to reflect the parameters of use patterns for which residue data are available. Details of the required label amendments are presented in the respective endnote for individual crops.
3. CBRS Nos. 17547 and 17855, DP Barcodes D229661 and D234815, 4/2/97, J. Abbotts.
4. DP Barcodes D238677, D238710, and D238712, 2/3/98, M. Xue.
5. Endosulfan uses on the following crops are not likely to be supported by The Endosulfan Task Force members for reregistration (see 62 FR 6776-6777 dated 2/13/97 and 63 FR 13246-13248 dated 3/18/98): alfalfa (grown for forage), artichokes, peas (grown for seed), safflower, sugar beets, sunflower, and watercress. No additional data are required for the commodities of the above crops provided they are removed from the labels. Should registrants other than the Task Force desire to support endosulfan uses on the above crops, they would be required to submit additional residue data reflecting the maximum registered use patterns. Data are required for oats, rye, barley, and wheat.
6. The SLN registrations of endosulfan on broccoli, cabbage, collards, kale, kohlrabi, radish, rutabaga, and turnips grown for seed in OR (OR770043) and WA (WA770016 and WA780029) have higher application rates than similar field-grown crops intended for human consumption. These registrations are considered nonfood uses based on an Agency policy memo entitled "Evaluation of Washington State Department of Agriculture Request for Nonfood/Nonfeed Status for Small-Seeded Crops (DP Barcode D212168, B. Schneider, 2/14/96).
7. The available data for carrot and potato can be translated to turnip root.
8. The available data for turnip tops (greens) do not adequately reflect the maximum registered use pattern. However, no additional data will be required since the data submitted for spinach, collards, kale, or mustard greens may be used to estimate endosulfan residues in/on turnip greens. This decision is consistent with that made in the Science Chapter of the Endosulfan Reregistration Standard.
9. The available data reflecting the maximum registered use pattern for collards are limited. However, no additional data will be required since the data submitted for spinach, sugar beet tops, kale, or mustard greens may be used to estimate endosulfan residues in/on collards. This decision is consistent with that made in the Science Chapter of the Endosulfan Reregistration Standard.
10. The available data reflecting the maximum registered use pattern for mustard greens are limited. However, no additional data will be required since the data submitted for spinach, collards, kale, or turnip greens may be used to estimate endosulfan residues in/on mustard greens. This decision is consistent with that made in the Science Chapter of the Endosulfan Reregistration Standard.
11. Label revisions are required for beans. Most endosulfan labels specify that "use on lima beans that are to be removed from the field for processing is prohibited". The Agency does not believe that such a restriction is practical and enforceable, and therefore, this restriction must be removed from the label.
12. The Agency will allow translation of residue data among morphologically related crops with similar use patterns in order to satisfy reregistration requirements. This decision is consistent with that made in the Science Chapter of the Endosulfan Reregistration Standard and/or Endosulfan Update. Translation of residue data may, however, preclude the establishment of crop group tolerances.

- a. The available data for tomatoes may be translated to eggplant.
 - b. The available data for cucumber, melon, and summer squash may be translated to pumpkin and winter squash.
 - c. The available data for peaches may be translated to apricots and nectarines.
 - d. The available data for almonds may be translated to pecans.
13. The use of endosulfan on nonbearing citrus trees and citrus nursery stocks is a nonfood use. The registered labels contain restrictions specifying that applications of endosulfan to bearing trees that will bear fruits within 12 months is prohibited.
14. Endosulfan is presently not registered by The Endosulfan Task Force members on mustard seed, raspberries, sugarcane, and watercress. If registrants other than the Task Force intend to support uses of endosulfan on the above crops, then residue data reflecting the maximum registered use patterns are required.
15. Reviewed under PP#7E1940.
16. No additional data are required provided that label revisions are made for all endosulfan labels with use claims on almonds to specify a 39 or 58-day PHI for which adequate data are available; presently, no PHI has been established for almonds.
17. No additional data are required provided that label revisions are made for all endosulfan labels with use claims on filberts to specify a 76-day PHI for which adequate data are available; presently, the established PHI for filberts is 1 day.
18. Because the available data for almonds may be translated to pecans, the requested label revisions for almonds also apply to pecans. All endosulfan labels with use claims on pecans should be amended to specify a 58-day PHI; presently, no PHI has been established for pecans.
19. No additional data are required provided that label revisions are made for all endosulfan labels with use claims on walnuts to specify a 36-day PHI for which adequate data are available; presently, no PHI has been established for walnuts.
20. No additional data are required for sweet corn (K + CWHR). However, the following label revisions are required for all endosulfan product labels with use claims on sweet corn to reflect the parameters of use pattern from the submitted sweet corn field trials: a maximum of two foliar applications per growing season at 1.0 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 7-day PHI.
21. DP Barcode 242935, 9/2/98, J. Punzi
22. The registrants must modify all product labels with uses on sweet corn to remove the feeding restriction for sweet corn forage and stover because the Agency no longer considers this restriction to be appropriate. IR-4's submission of data concerning magnitude of the residue in sweet corn forage and stover were found to be only marginally adequate because of insufficient geographic representation. The registrants will be required to propose tolerances and PHIs for endosulfan residues in/on sweet corn forage and stover. The registrants should propose a tolerance of 12 ppm in/on sweet corn forage (7 day PHI) and 14 ppm in/on sweet corn stover (11 day PHI).
23. CB No. 639, 7/15/86, R. Cook.

24. The SLN registrations of endosulfan on alfalfa grown for seed in CA (CA860035), NV (NV860005), and WA(880012) can be considered a nonfood use assuming the individual states have adequate mechanism to ensure that the treated crop is not diverted for consumption by humans and is not fed to livestock. The SLN labels specify restrictions prohibiting the feeding or grazing of treated foliage, crop residues, or seed millings and the use of treated seed for livestock food or feed.
25. The SLN registration of endosulfan on clover grown for seed in CA (CA900031) can be considered a nonfood use assuming the State of CA has adequate mechanism to ensure that the treated crop is not diverted for consumption by humans and is not fed to livestock. The SLN label specifies restrictions prohibiting the use of crop refuse as food or feed for livestock.
27. The following are required: A processing study depicting the potential for concentration of endosulfan residues of concern in barley, oats, and rye processed from grains bearing measurable, weathered residues. If residues concentrate then an appropriate tolerance must be proposed. Field trial data are required for barley hay; oat forage and hay; rye forage; wheat forage, and hay.
35. DP Barcode D251525, 5/26/99, S. Devito.
36. DP Barcode D 258716, 12/22/99, S. Mason.

TOLERANCE REASSESSMENT SUMMARY

Tolerances for residues of endosulfan in/on plant and animal commodities are established under 40 CFR §180.182. Tolerances for residues of endosulfan in processed commodities are established under 40 CFR §185.2600. Endosulfan tolerances are currently expressed in terms of the total residues of endosulfan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] and its metabolite, endosulfan sulfate [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide]. The current endosulfan tolerance expression does not specify the two stereo isomers of the parent compound.

The HED Metabolism Assessment Review Committee has determined that tolerances for crop and livestock commodities should continue to be expressed as residues of the parent (α and β isomers) and the sulfate metabolite. However, the Committee recommended that the tolerance expression be revised in order to specify the α and β isomers of the parent. Some toxicology data requirements remain outstanding, and the Committee may revisit this decision after those requirements are satisfied.

The Agency has recently updated the list of raw agricultural and processed commodities and feedstuffs derived from crops (Table 1, OPTS GLN 860.1000). As a result of changes to Table 1, endosulfan tolerances for certain commodities which have been removed from Table 1 need to be revoked, and some commodity definitions must be corrected. In addition, tolerances for commodities for which there are currently no registered uses of endosulfan need to be revoked. A summary of endosulfan tolerance reassessments is presented in Table 8.

Tolerances Listed Under 40 CFR §180.182:

Pending label revisions for some crops, sufficient field trial data have been submitted (or were translated when appropriate) to reassess the established tolerances for the following plant commodities, **as defined**: almonds; almonds, hulls; apples; apricots; beans; blueberries; broccoli; Brussels sprouts; cabbage; carrots; cauliflower; celery; cherries; collards; corn, sweet (K+CWHR); cottonseed; cotton gin byproducts; cucumbers; eggplant; filberts; grapes; kale; lettuce; macadamia nuts; melons; mustard greens; nectarines; peaches; pears; peas, succulent; pecans; peppers; pineapples; plums; potatoes; prunes; pumpkins; spinach; squash, summer; squash, winter; strawberries; sweet potatoes; tomatoes; turnips; and walnuts. Since the task force wishes to keep the uses of endosulfan on wheat, oats, rye, and barley additional data will be required (see footnotes to tolerance reassessment).

The reregistration of endosulfan uses on the following crops are not likely to be supported by The Endosulfan Task Force members: alfalfa (grown for forage), artichokes, peas (grown for seed), safflower, sugar beets, sunflower, and watercress. Therefore, the established tolerances for the respective commodities of the above crops should be revoked concomitant with the deletions of these uses from all endosulfan labels.

Endosulfan is presently not registered by The Endosulfan Task Force members on mustard seed, raspberries, sugarcane, and watercress. The established tolerances should be revoked unless registrants other than The Endosulfan Task Force members intend to support endosulfan uses and submit additional data.

The available residue data suggest that the established tolerance levels for the following plant commodities should be decreased from 2.0 to 1.0 ppm: apples; cucumbers; eggplant; melons; pineapples; pumpkins; squash, summer; squash, winter; and tomatoes. At the registrants' option and initiative, they may propose a crop group tolerance for Cucurbit Vegetables Group (Crop Group 9) since adequate data are available for cucumbers, melons, and squash which are the representative commodities of this crop group.

The available residue data suggest that the established tolerance levels for the following commodities should be increased, toxicological considerations permitting: broccoli (from 2.0 to 3.0 ppm); cabbage (from 2.0 to 4.0 ppm); celery (from 2.0 to 4.0 ppm); lettuce, head (from 2.0 to 11.0 ppm); and lettuce, leaf (from 2.0 to 3.0 ppm); Blueberry (from 0.1 to 0.3 ppm); barley grain (from 0.1 to 0.3 ppm); and barley straw (from 0.2 to 0.4); rye grain (from 0.1 to 0.3); and rye straw (from 0.2 to 0.3 ppm); oats grain (from 0.1 to 0.3); and oats straw (from 0.2 to 0.4 ppm); and oats grain (from 0.1 to 0.3); and wheat straw (from 0.2 to 0.4 ppm).

The expected dietary burdens of endosulfan to beef and dairy cattle were re-calculated following tolerance reassessment of livestock feed items. Livestock feeding studies reflecting the re-calculated dietary burden are available. Following evaluation of feeding data, the Agency issues the following conclusions: (I) the tolerance for milk fat (=N in whole milk) at 0.5 ppm should be increased to 2.0 ppm; (ii) the tolerances for meat byproducts of cattle, goats, hogs, horses, and sheep at 0.2 ppm should be replaced with separate tolerances for meat byproducts (except liver) at 1.0 ppm and liver at 5.0 ppm; and (iii) the tolerance for fat should be increased from 0.2 to 13 ppm.

The available poultry feeding data suggest that it is not possible to establish with certainty whether finite residues of endosulfan will be incurred, but there is no reasonable expectation of finite residues (Category 3 of 40 CFR §180.6). Therefore, tolerances are not required for eggs and poultry tissues.

Tolerance to be Proposed Under 40 CFR §180.182:

Tolerances for the combined residues of endosulfan (α and β isomers) and its metabolite endosulfan sulfate in/on: pearled barley, barley hay, flour, and bran; oats forage, hay, flour and rolled oats; rye forage, flour and bran; wheat forage, hay, and aspirated grain fractions must be proposed once adequate field residue data, reflecting the maximum registered use patterns, have been submitted and evaluated.

The apple processing study indicates that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate concentrated in dried and wet apple pomace (17x and 6x, respectively);

no concentration of endosulfan residues was observed in apple juice. A tolerance for dried apple pomace is not required as it is no longer considered a major livestock feed item and its entry has been deleted from Table 1. A tolerance for apple juice is also not warranted. However, based on the highest average field trial combined residues in/on the RAC and a concentration factor of 6x, the maximum expected endosulfan residues in wet apple pomace is 4.62 ppm. Therefore, a tolerance for the combined endosulfan residues in wet apple pomace must be proposed at 5.0 ppm.

The pineapple processing study indicates that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate concentrated up to 7x in peel and 41x in bran processed from whole pineapples bearing detectable endosulfan residues; no concentration of endosulfan residues was observed in pineapple pulp and juice. According to Table 1, residue data are only required for process residue and juice. Pineapple process residue (also known as wet bran) is a waste byproduct from the fresh-cut product line that includes pineapple tops (minus crown), bottoms, peels, any trimmings with peel cut up, and the pulp (left after squeezing for juice). Based on a HAFT combined endosulfan residues of 0.44 ppm (see Appendix) in/on the RAC and a concentration factor of 41x, the maximum expected total endosulfan residues in pineapple process residue is 18.04 ppm. Therefore, a tolerance for the combined endosulfan residues in pineapple process residue must be proposed at 20 ppm. A tolerance for pineapple juice is not warranted.

The available tomato processing data indicate that endosulfan residues of concern marginally concentrate (1.2x) in tomato paste processed from treated tomatoes. The concentration of residues in tomato paste is not significant enough to warrant a tolerance for this commodity. A tolerance for tomato puree is also not warranted.

Processing data for oats, barley, wheat, and rye are required.

Tolerance Listed Under 40 CFR §185.2600:

Adequate data are available to reassess the established tolerance for dried tea leaves. The established tolerance for dried tea (reflecting less than 0.1 ppm residues in beverage tea) listed under 40 CFR §185.2600 should be moved to 40 CFR 180.182 because the enacted FQPA stipulates that tolerances for pesticide residues in all types of food (raw or processed) be set under the same provisions of the law

Pending Tolerance Petition:

FAP#9H5579: Hoechst Celanese Corporation proposed the establishment of tolerances for residues of endosulfan and endosulfan sulfate in dried hops and spent hops imported from Germany, each at 10 ppm. Toxicology considerations permitting, the Chemistry Branch (known formally as DEB) recommended in favor of the proposed tolerances subject to the registrant limiting the number of applications to three (CB No. 5098, R.W. Cook, 7/12/89).

Table 8. Tolerance Reassessment Summary for Endosulfan.

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [<i>Correct Commodity Definition</i>]
Tolerance Listed Under 40 CFR §180.182			
Alfalfa, fresh	0.3	Revoke	Endosulfan use on alfalfa is not likely to be supported. The established tolerances for these commodities should be revoked concomitant with the deletion of alfalfa as a use site from all endosulfan labels.
Alfalfa, hay	1.0	Revoke	
Almonds	0.2	0.30	The available data indicate that residues of endosulfan or endosulfan sulfate were nondetectable in/on almond kernels harvested 39 or 58 days following the last of multiple applications of a representative WP formulation at exaggerated (2.4x) seasonal rate (see Appendix); the reported limits of detection were 0.2 and 0.1 ppm respectively. A preharvest interval for almonds has presently not been established. Provided that label revisions are made to specify a 39- or 58-day PHI, no additional data are required for almond nutmeat, and the tolerance is reassessed at 0.2 ppm. [<i>Almond, nutmeat</i>]
Almonds, hulls	1.0	1.0	Following applications of a representative WP formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on almond hulls ranged from 0.20 to 0.39 ppm (see Appendix). [<i>Almond, hulls</i>]
Apples	2.0	1.0	Data reflecting the maximum registered use pattern are unavailable. However, data reflecting applications at exaggerated (2x) seasonal rate indicate that the combined endosulfan residues in/on apples ranged from 0.46 to >0.47 ppm using the EC formulation, and from 0.69 to 0.84 ppm using the WP formulation. The reassessed tolerance is in harmony with the proposed Codex MRL (Step 5/8) of 1.0 ppm for pome fruits. [Apple]
Apricots	2.0	2.0	The available data for peaches may be translated to apricots. [<i>Apricot</i>]
Artichokes	2.0	Revoke	Endosulfan use on artichokes is not likely to be supported. The established tolerance for this commodity should be revoked concomitant with the deletion of artichoke as a use site from all endosulfan labels. [<i>Artichoke, globe</i>]
Barley, grain	0.1	0.30	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on barley grain ranged from <0.15 to <0.30 ppm..

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Barley, straw	0.2	0.40	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on barley straw ranged from <0.15 to 0.35 ppm..
Beans	2.0	2.0 (<i>Bean, dry and succulent</i>)	Following applications of a representative WP or EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues were below 2.0 ppm in/on lima beans, snap beans, red kidney beans, string beans, and sutter red beans (see Appendix). [Bean, succulent seed]
Beets, sugar, without tops	0.1	Revoke	Endosulfan use on sugar beets is not likely to be supported. The established tolerance for this commodity should be revoked concomitant with the deletion of sugar beet as a use site from all endosulfan labels. [Beet, sugar, root]
Blueberries	0.1	0.30	Following applications of a representative EC formulation reflecting exaggerated use pattern, no detectable residues (<0.1 ppm) of endosulfan or endosulfan sulfate were detected in/on blueberries (see Appendix). [Blueberry]
Broccoli	2.0	3.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on broccoli ranged from 0.16 to 2.41 ppm using the EC formulation, and from 0.26 to 1.92 ppm using the WP formulation. The registrants may elect to retain the current tolerance level by amending the registered broccoli use pattern <u>and</u> by submitting additional residue data in support of any label amendments.
Brussels sprouts	2.0	2.0	Data reflecting the maximum registered use pattern are unavailable. However, data reflecting applications of a representative EC formulation at exaggerated (3.5x) seasonal rate indicate that the combined residues of endosulfan in/on Brussels sprouts were below 2.0 ppm (see Appendix).
Cabbage	2.0	4.0	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues were 3.1 ppm in/on cabbage with wrapper leaves and nondetectable (<0.02 ppm) in/on cabbage without wrapper leaves (see Appendix). The reassessed tolerance is based on data from cabbage with wrapper leaves.

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Carrots	0.2	0.20	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on carrots were generally below 0.2 ppm (see Appendix). [Carrot]
Cattle, fat	0.2	13	The highest residues obtained in milk and tissue samples collected from the highest feeding level of the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows : Fat of cattle, goats, hogs, horses, and sheep 13.0 ppm Meat byproducts (except liver) of cattle, goats, hogs, and horses 1.0 ppm Liver of cattle, goats, hogs, and horses 5.0 ppm Meat of cattle, goats, hogs, and horses 2.0 ppm Milk, fat 2.0 ppm
Cattle, mbyp	0.2	Cattle, mbyp = 1.0 Cattle, liver = 5.0	[Cattle, meat byproducts (except liver)] [Cattle, liver]
Cattle, meat	0.2	2.0	
Cauliflower	2.0	2.0	Following applications of a representative EC formulation reflecting the maximum registered as well as exaggerated use patterns, the combined endosulfan residues in/on cauliflower were below 0.78 ppm. Due to the limited number of data points reflecting treatments at 1x, the cauliflower tolerance is reassessed at 2.0 ppm (see Appendix).
Celery	2.0	4.0	In lieu of proposing a higher tolerance, the registrants elected to retain the current tolerance level by amending the registered celery use pattern <u>and</u> by submitting additional residue data in support of any label amendments. These new residue data reflect application(s) of representative emulsifiable concentrate (EC) and wettable powder (WP) formulations at the respective maximum registered seasonal rates for celery. However, the treated samples were collected at PHI 14 days for celery, that are longer than the current minimum PHIs of 4 days. The combined residues in/on treated untrimmed samples ranged from 0.62 to 2.52 ppm following application of the EC formulation, and 0.52 and 3.72 following application of the WP formulation.

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Cherries	2.0	Cherry, sweet = 2.0 Cherry, sour = 2.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on sweet cherries ranged from <0.17 to 1.46 ppm using the EC formulation, and from <0.15 to 0.33 ppm using the WP formulation. The combined endosulfan residues in/on sour cherries ranged from <0.15 to 1.35 ppm using the EC formulation, and from <0.15 to 0.19 ppm using the WP formulation. [Cherry, sweet] and [Cherry, sour]
Collards	2.0	2.0	The available data reflecting the maximum registered use pattern for collards are very limited. Following application of a representative EC formulation at 0.75x the maximum registered seasonal rates, the combined endosulfan residues in/on collards harvested 20 days posttreatment were 1.591-1.782 ppm (see Appendix). The data submitted for spinach, sugar beet tops, kale, or mustard greens may additionally be used to estimate endosulfan residues in/on collards.
Corn, sweet (K+CWHR)	0.2	0.20	The reassessed tolerance is contingent upon the requested label revisions specifying the parameters of use patterns for which adequate data are available.
Corn, sweet forage	-	12	The reassessed tolerance is contingent upon the requested label revisions specifying the parameters of use patterns for which adequate data are available
Corn, sweet stover	-	14	The reassessed tolerance is contingent upon the requested label revisions specifying the parameters of use patterns for which adequate data are available
Cottonseed	1.0	1.0	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on cottonseed were below 1.0 ppm (see Appendix). [Cotton, undelinted seed]

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Cotton gin byproducts	-	30	The combined residues of endosulfan (α and β isomers) and endosulfan sulfate ranged from 8.27 to 27.5 ppm in/on cotton gin byproducts harvested 13-14 days following a treatment schedule (after bolls open) similar to the one described above for cottonseed. No cotton gin byproducts data reflecting treatments made to cotton plants until bolls open have been submitted; however, because residues are expected to be lower from this use pattern, the Agency will not require additional cotton gin byproducts data for reregistration.
Cucumbers	2.0	1.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on cucumbers ranged from 0.26 to 0.66 ppm using the EC formulation, and from <0.16 to 0.40 ppm using the WP formulation. Adequate data are now available for cucumber, melon, and squash which are the representative commodities of Cucurbit Vegetables Group (Crop Group 9). [Cucumber]
Eggplant	2.0	1.0	The available data for tomato may be translated to eggplant.
Filberts	0.2	0.20	The available data indicate that residues of endosulfan or endosulfan sulfate were nondetectable in/on filbert nuts harvested 76-88 days following the last of multiple applications of representative WP formulations at 1.3-1.6x the maximum registered seasonal rate. The method's limit of detection was not specified. The established PHI for filberts is 1 day. Provided that label revisions are made to specify a 76-day PHI, no additional data are required for filberts, and the tolerance is reassessed at 0.2 ppm. [Filbert]
Goats, fat	0.2	13	The highest residues obtained in milk and tissue samples collected from the highest feeding level of the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows : Fat of cattle, goats, hogs, horses, and sheep 13.0 ppm Meat byproducts (except liver) of cattle, goats, hogs, and horses 1.0 ppm Liver of cattle, goats, hogs, and horses 5.0 ppm Meat of cattle, goats, hogs, and horses 2.0 ppm Milk, fat 2.0 ppm
Goats, mbyyp	0.2	Goats, mbyyp = 1.0 Goats, liver = 5.0	[Goats, meat byproducts (except liver)] [Goats, liver]

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Goats, meat	0.2	2.0	
Grapes	2.0	0.6	Following applications of a representative WP formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on grapes were 0.38-0.51 ppm (see Appendix). [Grape]
Hogs, fat	0.2	13	The highest residues obtained in milk and tissue samples collected from the highest feeding level of the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows : Fat of cattle, goats, hogs, horses, and sheep 13.0 ppm Meat byproducts (except liver) of cattle, goats, hogs, and horses 1.0 ppm Liver of cattle, goats, hogs, and horses 5.0 ppm Meat of cattle, goats, hogs, and horses 2.0 ppm Milk, fat 2.0 ppm
Hogs, mbyp	0.2	Hogs, mbyp = 1.0 Hogs, liver = 5.0	[Hogs, meat byproducts (except liver)] [Hogs, liver]
Hogs, meat	0.2	2.0	
Horses, fat	0.2	13	The highest residues obtained in milk and tissue samples collected from the highest feeding level of the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows : Fat of cattle, goats, hogs, horses, and sheep 13.0 ppm Meat byproducts (except liver) of cattle, goats, hogs, and horses 1.0 ppm Liver of cattle, goats, hogs, and horses 5.0 ppm Meat of cattle, goats, hogs, and horses 2.0 ppm Milk, fat 2.0 ppm
Horses, mbyp	0.2	Horses, mbyp = 1.0 Horses, liver = 5.0	[Horses, meat byproducts (except liver)] [Horses, liver]
Horses, meat	0.2	2.0	
Kale	2.0	2.0	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on kale were 1.214-1.295 ppm (see Appendix).

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Lettuce	2.0	Lettuce, head = 11 Lettuce, leaf = 3.0	<p>Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on head lettuce (with wrapper leaves) ranged from <0.18 to 4.28 ppm using the EC formulation, and from 0.21 to 10.11 ppm using the WP formulation. The combined endosulfan residues in/on leaf lettuce ranged from <0.15 to 4.49 ppm using the EC formulation, and from 0.17 to 5.72 ppm using the WP formulation. In lieu of proposing higher tolerances, the registrants may elect to retain the current tolerance level by amending the registered lettuce use pattern <u>and</u> by submitting additional residue data in support of any label amendments.</p> <p>In a more recent submission (D251525) the combined endosulfan residues in/on leaf lettuce ranged from 0.19 to 2.62 ppm following applications of the EC formulation, and from <0.15 to 2.20 ppm following applications of the WP formulation. However the PHI was extended to 21 days.</p> <p>[Lettuce, head] and [Lettuce, leaf]</p>
Macadamia nuts	0.2	0.20	<p>Following applications of a representative WP or EC formulation reflecting exaggerated use pattern, no detectable residues of endosulfan or endosulfan sulfate were detected in/on macadamia nuts (see Appendix). The analytical method's limit of detection was not specified.</p> <p>[Macadamia nut]</p>
Melons	2.0	1.0	<p>Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on cantaloupes ranged from <0.15 to 0.50 ppm using the EC formulation, and from 0.22 to 0.76 ppm using the WP formulation. [Melon subgroup (crop subgroup 9A)]</p>
Milk, fat (=N in whole milk)	0.5	2.0	[Milk]
Mustard greens	2.0	2.0	<p>The available data reflecting the established 21-day PHI for mustard greens are very limited (see Appendix). The data submitted for spinach, collards, kale, or turnip greens may be used to estimate endosulfan residues in/on mustard greens.</p>

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Mustard seed	0.2	Revoke	Endosulfan is presently not registered by The Endosulfan Task Force members on mustard seed. The tolerance should be revoked unless registrants other than The Endosulfan Task Force members intend to support endosulfan use on mustard seed and submit additional data.
Nectarines	2.0	2.0	The available data for peaches may be translated to nectarines. [Nectarine]
Oats, grain	0.1	0.30	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on oat grain ranged from <0.15 to <0.30 ppm..
Oats, straw	0.2	0.40	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on oat straw ranged from <0.15 to <0.32 ppm..
Peaches	2.0	2.0	Following applications of a representative WP formulation approximating the maximum registered use pattern, the combined endosulfan residues in/on peaches were below 2.0 ppm (see Appendix). [Peach]
Pears	2.0	2.0	Following applications of a representative WP formulation approximating the maximum registered use pattern, the combined endosulfan residues in/on pears were 0.95-1.00 ppm. Due to the limited number of data points reflecting treatments at 1x, the pear tolerance is reassessed at 2.0 ppm (see Appendix). [Pear]
Peas, succulent	2.0	2.0	Following applications of a representative EC formulation approximating the maximum registered use pattern, the combined endosulfan residues in/on succulent peas were below 2.0 ppm (see Appendix). [Pea, succulent]
Pecans	0.2	0.30	The available data for almonds may be translated to pecans pending label revisions. All endosulfan labels with use claim on pecans should be amended to specify a 58-day PHI. [Pecan]
Peppers	2.0	2.0	Following applications of a representative WP or EC formulations approximating the maximum registered use pattern, the combined endosulfan residues in/on bell and sweet peppers are not expected to exceed 2.0 ppm (see Appendix). [Pepper]

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Pineapples	2.0	1.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on pineapples ranged from >0.08 to 0.50 ppm. [Pineapple]
Plums	2.0	2.0	Data reflecting the maximum registered use pattern are unavailable. However, data reflecting applications of a representative WP or EC formulation at an exaggerated seasonal rate indicate that the combined endosulfan residues in/on French prunes were below 2.0 ppm. [Plum]
Potatoes	0.2	0.2	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on potatoes were mostly nondetectable (see Appendix). The analytical method's limit of detection was not specified. [Potato]
Prunes	2.0	2.0	Data reflecting the maximum registered use pattern are unavailable. However, data reflecting applications of a representative WP or EC formulation at an exaggerated seasonal rate indicate that the combined endosulfan residues in/on French prunes were below 2.0 ppm. [Prune]
Pumpkins	2.0	1.0	The available data for cucumber, melon, and summer squash may be translated to pumpkin and winter squash. [Pumpkin]
Rape seed	0.2	0.20	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on rape seed were 0.03 ppm. Due to the limited number of data points reflecting treatments at 1x, the rape seed tolerance is reassessed at 0.2 ppm (see Appendix). [Rape, seed]
Raspberries	0.1	Revoke	Endosulfan is presently not registered by The Endosulfan Task Force members on raspberries. The tolerance should be revoked unless registrants other than The Endosulfan Task Force members intend to support endosulfan use on raspberries and submit additional data. [Raspberry]
Rye, grain	0.1	0.30	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on rye grain ranged from <0.15 to <0.30 ppm..

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Rye, straw	0.2	0.30	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on rye straw ranged from <0.15 to <0.30 ppm..
Safflower seed	0.2	Revoke	Endosulfan use on safflower is not likely to be supported. The established tolerance for this commodity should be revoked concomitant with the deletion of safflower as a use site from all endosulfan labels.
Sheep, fat	0.2	13	The highest residues obtained in milk and tissue samples collected from the highest feeding level of the combined residues of endosulfan (α and β isomers) and endosulfan sulfate in animal commodities are as follows : Fat of cattle, goats, hogs, horses, and sheep 13.0 ppm Meat byproducts (except liver) of cattle, goats, hogs, and horses 1.0 ppm Liver of cattle, goats, hogs, and horses 5.0 ppm Meat of cattle, goats, hogs, and horses 2.0 ppm Milk, fat 2.0 ppm
Sheep, mbyp	0.2	Sheep, mbyp = 1.0 Sheep, liver = 5.0	[<i>Sheep, meat byproducts (except liver)</i>] [<i>Sheep, liver</i>]
Sheep, meat	0.2	2.0	
Spinach	2.0	2.0	Following applications of a representative EC formulation reflecting the maximum registered use pattern, the combined endosulfan residues in/on spinach ranged from 0.619 to 1.260 ppm (see Appendix) The reassessed tolerance is in harmony with the proposed Codex MRL (Step 5/8) of 2.0 ppm for spinach.
Squash, summer	2.0	1.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on summer squash ranged from <0.15 to 0.23 ppm using the EC formulation, and from <0.15 to 0.25 ppm using the WP formulation.
Squash, winter	2.0	1.0	The available data for cucumber, melon, and summer squash may be translated to pumpkin and winter squash.

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Strawberries	2.0	2.0	Data reflecting the maximum registered use pattern are unavailable. Data reflecting applications of a representative EC formulation at 0.33-0.67x the maximum seasonal rate indicate that the combined residues of endosulfan in/on strawberries without caps were below 0.60 ppm (see Appendix). By extrapolation to the maximum use rate, the Science Chapter to the Endosulfan Reregistration Standard concluded that residues are not likely to exceed the established tolerance. [Strawberry]
Sugarcane	0.5	Revoke	Endosulfan is presently not registered by The Endosulfan Task Force members on sugarcane. The tolerance should be revoked unless registrants other than The Endosulfan Task Force members intend to support endosulfan use on sugarcane and submit additional data.
Sunflower seed	2.0	Revoke	Endosulfan use on sunflower is likely not going to be supported. The established tolerance for this commodity should be revoked concomitant with the deletion of sunflower as a use site from all endosulfan labels.
Sweet potatoes	0.2	0.15	The available data indicate that endosulfan residues of concern were each <0.05 ppm (nondetectable) in/on sweet potatoes following treatments at the maximum registered use pattern. [Sweet potato]
Tomatoes	2.0	1.0	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on tomatoes ranged from <0.15 to 0.91 ppm using the EC formulation, and from <0.15 to 0.97 ppm using the WP formulation. [Tomato]
Turnips, greens	2.0	2.0	Data reflecting the maximum registered use pattern are unavailable. The data submitted for spinach, collards, kale, or mustard greens may be used to estimate residues in/on turnip greens. [Turnip, tops]
Walnuts	0.2	0.20	The available data indicate that residues of endosulfan or endosulfan sulfate were nondetectable in/on walnuts harvested 36-39 days following the last of multiple applications of a representative WP and EC formulations at exaggerated (2.7-3.3x) seasonal rate; the limits of detection were not reported. A preharvest interval for walnuts has presently not been established. Provided that label revisions are made to specify a 36-day PHI, no additional data are required for walnut, and the tolerance is reassessed at 0.2 ppm (See Science Chapter). [Walnut]

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Watercress	2.0	Revoke	Endosulfan is presently not registered by The Endosulfan Task Force members on watercress. The tolerance should be revoked unless registrants other than The Endosulfan Task Force members intend to support endosulfan use on watercress and submit additional data.
Wheat, grain	0.1	0.30	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on wheat grain ranged from <0.15 to <0.30 ppm..
Wheat, straw	0.2	0.40	Following applications reflecting the maximum registered use pattern, the combined endosulfan residues in/on wheat straw ranged from <0.15 to <0.38 ppm..

Table 9 (continued).

Commodity	Established Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments [Correct Commodity Definition]
Tolerance To Be Proposed Under 40 CFR §180.182			
Apple, pomace, wet	--	5.0	The recommended tolerance is based on a HAFT combined endosulfan residue of 0.77 ppm and a concentration factor of 6x.
Corn, sweet, forage	--	12	The submitted data for sweet corn forage and stover indicate that the combined residues of endosulfan (α and β isomers) and endosulfan sulfate were 4.2-12.0 ppm in/on sweet corn forage (n=6 samples) harvested 7 days and 0.76-13.92 ppm in/on sweet corn stover (n=6 samples) harvested 11-45 days following the last of two foliar applications, with a 6- to 7-day retreatment interval of a representative 3 lb/gal EC formulation at 1.0 lb ai/A/application (1x the proposed maximum single and seasonal application rates) using ground equipment.
Corn, sweet, stover	--	14	
Cotton, gin byproducts	--	30	
Pineapple process residue	--	18	The recommended tolerance is based on a HAFT combined endosulfan residue of 0.44 ppm and a concentration factor of 41x.
Turnip, root	--	0.20	The recommended tolerance is based on translation of data from carrot and potato.
Tolerance Listed Under 40 CFR §185.2600			
Dried tea	24 (reflecting < 0.1 ppm residues in beverage tea)	24 (reflecting < 0.1 ppm residues in beverage tea)	This tolerance should be moved to 40 CFR §180.182.

CODEX HARMONIZATION

The Codex Alimentarius Commission has established several maximum residue limits (MRLs) for residues of endosulfan in/on various plant and animal commodities. The Codex MRLs are expressed in terms of the sum of α - and β -endosulfan and endosulfan sulfate (fat soluble). When the U.S. tolerance expression is revised to specify the α and β isomers of the parent, Codex MRLs and U.S. tolerances will be harmonized. A numerical comparison of the Codex MRLs and the corresponding **reassessed** U.S. tolerances is presented in Table 9.

Table 9 indicates that U.S. tolerances and the Codex MRLs for endosulfan are compatible for carrot, cottonseed, fruits, meat, pome fruits (apples), potato, spinach, and sweet potato. For the remainder of commodities listed in Table 9, the U.S. tolerances and the Codex MRLs are incompatible because of differences in registrations or good agricultural practices.

Table 10. Codex MRLs and applicable U.S. tolerances for endosulfan. Recommendations for compatibility are based on conclusions following reassessment of U.S. tolerances (see Table 8).

Commodity, As Defined	Codex		Reassessed U.S. Tolerance (ppm)	Comments
	MRL (mg/kg)	Step		
Alfalfa forage (green)	1	5/8	Revoke	Endosulfan use on alfalfa grown in the U.S. is not likely to be supported.
Broccoli	0.5	5	3.0	
Cabbages, Head	1	5	4.0	
Cabbages, Savoy	2	5	4.0	
Carrot	0.2	CXL	0.20	Compatibility exists.
Cauliflower	0.5	5	2.0	
Celery	2	5/8	4.0	
Chard	2	5	--	No U.S. registrations.
Cherries	1	5/8	2.0	
Chicory leaves	1	5	--	No U.S. registrations.
Clover	1	5/8	--	No U.S. registrations.
Common bean (pods and/or immature seeds)	0.5	5	2.0	
Cotton seed	1	CXL	1.0	Compatibility exists.
Cotton seed oil, crude	0.5	CXL	--	
Endive	1	5	--	No U.S. registrations.
Fruits	2	CXL	2.0 each for apricots, grapes, nectarines, peaches, pears, plums, prunes, and strawberries	Compatibility exists for some fruit crops.

Table 10 (continued).

Codex			Reassessed U.S. Tolerance (ppm)	Comments
Commodity, As Defined	MRL (mg/kg)	Step		
Garden peas (young pods)	0.5	5/8	--	No U.S. registrations.
Kale	1	5/8	2.0	
Lettuce, Head	1	5/8	11.0	
Lettuce, Leaf	1	5/8	3.0	
Meat	0.2 (carcass fat)	CXL	0.20	Compatibility exists.
Milks	0.02 ¹	CXL	0.50	
Onion, Bulb	0.2	CXL	--	No U.S. registrations.
Plums (including Prunes)	1	5/8	2.0	
Pome fruits	1	5/8	1.0	Compatibility exists.
Potato	0.2	CXL	0.20	Compatibility exists.
Rice	0.1	CXL	--	No U.S. registrations.
Spinach	2	5/8	2.0	Compatibility exists.
Sugar beet	0.1	5/8	Revoke	Endosulfan use on sugar beets grown in the U.S. is not likely to be supported.
Sugar beet leaves or tops	1	5/8	--	
Sweet potato	0.2	CXL	0.15	Compatibility exists.
Tea, Green, Black	30	CXL	24 (reflecting <0.10 ppm residues in beverage tea)	
Trefoil	1	5/8	--	No U.S. registrations.

¹ The residue is fat-soluble and MRLs for milk and milk products are derived as explained in the introductions to Volume XIII of Codex Alimentarius.

AGENCY MEMORANDA RELEVANT TO REREGISTRATION

CB No.: 639
DP Barcode: None
Subject: Response to Data Requirements Imposed by the Endosulfan Registration Standard. EPA Accession Number 261504. EPA Reg. No. 279-1380; 279-2306; 279-2659; 279-2924. Submission of Residue Data on Alfalfa Seed and Seed Screening.
From: R. Cook
To: G. LaRocca and Toxicology Branch
Dated: 7/15/86
MRID(s): 157148

CB No.: 5098
DP Barcode: None
Subject: FAP#9H5579. Endosulfan on Dried Hops. Evaluation of Analytical Method and Residue Data.
From: R. Cook
To: G. LaRocca and Toxicology Branch
Dated: 7/12/89
MRID(s): 41025101 and 41025102

CB No.: 7706
DP Barcode: None
Subject: CA900031. Endosulfan (Thiodan 3EC, EPA Reg. No. 279-2924). 24© Special Local Needs Registration for Application to Clover Grown for Seed Only.
From: M. Metzger
To: G. LaRocca/ D. Pilitt
Dated: 3/6/91
MRID(s): None

CB No.: 9117
DP Barcode: D167409
Subject: WA910029. Special Local Need-24© Registration for Application of Thiodan 3EC Insecticide (i.e., Endosulfan) for Control of Hornworm on Evening Primrose for Export to the United Kingdom for Processing Into Primrose Oil.
From: G. Otakie
To: G. LaRocca and Toxicology Branch
Dated: 1/23/92
MRID(s): None

CB No.: 8657

DP Barcode: D169219
Subject: Endosulfan. Determination of Anticipated Residues.
From: J. Abbotts
To: J. Housenger
Dated: 2/25/92
MRID(s): 41912201

CB Nos.: 12096 and 12099
DP Barcodes: D192502 and D192492
Subject: ID #CA930009: Special Local Need [24(c)] for Use of Endosulfan (Thiodan 50 WP) in Sweet Potatoes in California Only. ID #NV930004: Special Local Need [24(c)] for Use of Endosulfan (Thiodan 3 EC) on Seed Alfalfa in Nevada Only.
From: M. Rodriguez
To: George LaRocca/L. Arrington
Dated: 8/19/93
MRID(s): None

CB No.: None
DP Barcode: None
Subject: Data Call-in For Foliar Application of Endosulfan on Sweet Potatoes.
From: M. Rodriguez
To: E. Zager and R. Richards
Dated: 9/17/93
MRID(s): None

CB No.: 12683
DP Barcode: D195954
Subject: HI830003. Renewal of Special Local Need [24(c)] for Use of Endosulfan (Thiodan 3 EC) on Pineapple in Hawaii.
From: J. Stokes
To: G. LaRocca/S. Moats
Dated: 10/29/93
MRID(s): None

CB No.: 12683
DP Barcode: D195954
Subject: HI830003. Renewal of Special Local Need [24(c)] for Use of Endosulfan (Thiodan 3 EC) on Pineapple in Hawaii.
From: J. Stokes
To: G. LaRocca/S. Moats
Dated: 10/29/93
MRID(s): None

CB No.: 13484
DP Barcode: D201352
Subject: HI830003. Additional Comments on the Renewal of Special Local Need [24(c)] for Use of Endosulfan (Thiodan 3 EC) on Pineapple in Hawaii.
From: J. Stokes
To: G. LaRocca/S. Moats
Dated: 4/20/94
MRID(s): None

CB No.: 13451
DP Barcode: D201136
Subject: HI880008. Comments on the Renewal of Special Local Need [24(c)] for Use of Endosulfan (Thiodan 50 WP) on Macadamia Nuts in Hawaii.
From: J. Stokes
To: G. LaRocca/S. Moats
Dated: 4/28/94
MRID(s): None

CB No.: None
DP Barcode: None
Subject: Endosulfan Memo of Conference.
From: F. Suhre
To: CBRS Files
Dated: 11/29/94
MRID(s): None

CB No.: None
DP Barcode: None
Subject: Endosulfan (079401), Reregistration Case No. 0014 and Special Review. Acute Dietary Risk Concerns.
From: J. Abbots
To: C. Scheltema
Dated: 9/24/96
MRID(s): None

CB No.: 15111
DP Barcode: D212168
Subject: Evaluation of Washington State Department of Agriculture Request for Nonfood/Nonfeed Status for Small-Seeded Vegetable Seed Crops
From: B. Schneider
To: S. Johnson
Dated: 2/14/96
MRID(s): None

CB Nos.: 17547 and 17855
DP Barcodes: D229661 and D234815
Subject: Endosulfan (079401), Reregistration Case No. 0014 and Special Review. Registrant AgrEvo USA Company. Guideline 860.1300. Metabolism in Crops: Apple, Lettuce, and Cucumber, and Metabolism in Livestock: Cow and Hen.
From: J. Abbots
To: M. Metzger
Dated: 4/2/97
MRID(s): 44082701-44082703 and 44099101-44099102

CB No.: 17870
DP Barcode: D235211
Subject: Endosulfan (079401), Reregistration Case No. 0014. Issues to be Presented at the 4/21/97 Meeting of the HED Metabolism Committee.
From: J. Abbots
To: HED Metabolism Committee
Dated: 4/15/97
MRID(s): None

CB No.: 17888
DP Barcode: D235407
Subject: Results of the HED Metabolism Committee Meeting Held on 4/21/97: Endosulfan in Plants and Livestock.
From: J. Abbots
To: Health Effects Division Metabolism Committee
Dated: 5/1/97
MRID(s): None

CB No.: None
DP Barcodes: D240069
Subject: Endosulfan, Case 0014, Code 079401. Storage Stability Study (OPTS 860.1380)
From: M. Xue
To: S. DeVito
Dated: 1/26/98
MRID(s): 44396301

CB No.: None
DP Barcodes: D238677, D238710, and D238712
Subject: Endosulfan: PC Code 079401; Magnitude of the Residue and Processing Studies for Several Crops. Reregistration Case No. 0014.
From: M. Xue

To: S. DeVito
Dated: 2/3/98
MRID(s): 44346902-44346915

CB No.: None
DP Barcode: D240072
Subject: Endosulfan: PC Code 079401, Case 0014. Confined Rotational Crops Study (OPTS 860.1850)
From: M. Xue
To: S. DeVito
Dated: 2/17/98
MRID(s): 44393001

DP Barcode: D242935
Subject: Endosulfan: PC Code 079401, Case 0014. Magnitude of the Residue in Sweet Corn.
From: J. Punzi
To: P. Poli
Dated: 9/3/98
MRID(s): 44457001

DP Barcode: D251525
Subject: Endosulfan. Crop Field Trials: Magnitude of Endosulfan Residues in or on Celery or Leaf Lettuce: GLN 860.1500.
From: S. Devito, Ph.D.
To: Phil Budig
Dated: May 26, 1999
MRID(s): 44701201 and 44701202
DP Barcode: D253976
Subject: Endosulfan: Magnitude of Endosulfan Residues in or on Wheat Grain and Processed Commodities: GLN 860.1520.
From: S. Devito, Ph.D.
To: Phil Budig
Dated: May 27, 1999
MRID(s): 44762901

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DP Barcode: D258716
Subject: Endosulfan. 860.1500 and 860.1520: Magnitude of the Residue in/on Cottonseed and Processed Cottonseed; 860.1480: Residue in Meat and Milk.
From: S. Mason
To: Phil Budig
Dated: Dec 10, 1999
MRID(s): 44854101, 44854102, 44854103, and 44843702.

DP Barcode: D268415
Subject: Endosulfan. 860.1380: Storage Stability in Wheat/Processed Commodities.
From: J. Punzi
To: Phil Budig
Dated: Jan 00, 2001
MRID(s): 45190801

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00003588 FMC Corporation (1969) Analytical Method and Residues: [Endosulfan]. (Unpublished study received Sep 3, 1970 under 1F1034; CDL:093343-D)

00003600 FMC Corporation (1958) Petition for the Establishment of a Tolerance for Thiodan on Strawberry and Peach...Including a Description of the Analytical Methods Used. (Unpublished study including supplement, received Feb 9, 1960 under PP0237; CDL:090265-A)

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00003634 Stanovick, R.P. (1967) Determination of Thiodan I, II and Sulfate Residues in or on Sweet Corn (Husk, Cob and Kernels): M-2129. Includes undated method. (Unpublished study received Jun 14, 1967 under 279-1182; submitted by FMC Corp., Philadelphia, Pa.; CDL:008892-A)

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00003676 FMC Corporation (1964) Recovery of Thiodan Isomers and Sulfate from Clarified Sugarcane Juice after Evaporation. (Unpublished study including letter dated Apr 15, 1964 from W.C. Ferguson to T.H. Harris, received Apr 15, 1964 under unknown admin. no.; CDL: 109877-A)

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